Harry B. Shuman

# FULL DENTURE PROSTHESIS

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Harry B Shuman

BY

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TO

GEORGE HENRY WILSON, D.D.S.

WHOSE SYMPATHETIC INTEREST HAS STIMULATED, WHOSE SPLENDID IDEALS HAVE INSPIRED, AND WHOSE SANE JUDGMENTS HAVE STEADIED THE YOUNGER MEN OF OUR PROFESSION

## PREFACE

Whatever justification "Full Denture Prosthesis" may have, its immediate pragmatic value to students and general practitioners has been the author's first consideration. The principles presented, the technic followed, the materials and equipment used, the attitude toward patients, have been productive of results.

Accordingly, theories are mentioned only when an understanding of the principles involved may seem to require reference to them. While endeavoring to avoid a dogmatic presentation, the author has undertaken to emphasize the supreme importance of basic principles. These seem to him to be clearly established and their application comparatively simple. He hopes that the service rendered by the construction of the most efficient, comfortable and esthetic full dentures that prosthetic dentistry can provide, will be enlarged; he hopes that this book may serve to remove from full denture prosthesis some of the mystery which has shrouded it, and to free it from useless accretions and traditions, which have tended to fill the beginner with forebodings and to surround the successful prosthetist with a halo usually reserved for those who have seemed to accomplish the impossible.

The author's indebtedness to others is very great; where this is specific, effort has been made to give credit in the text. He is indebted to many others for suggestions and inspiration, which have largely determined his present attitude toward his subject; he regrets that he is not now sufficiently conscious of these sources to acknowledge them except in this general way. A list of these would include the names of all those who have contributed to the progress of full denture prosthesis during the past ten years at least. Even earlier would appear the names of Doctors George H. Wilson, Alfred Gysi, Rupert E. Hall, and Martin Dewey.

Doctors William L. Shearer, William A. Colburn, and Walter L. Cronkite, although not responsible for the views as herein expressed, have very largely influenced the author's attitude toward phases of mouth preparation.

Acknowledgment is made to the *Dental Summary* for a number of electrotypes used in a series of the author's articles.

Originality and priority will be recognized by those who are inter-

ested in this aspect of prosthesis; the author makes no fetishes of these; his desire is that this presentation may help others in some degree as others have helped him.

Finally, as full recognition as can be given is due my associate in practice, Doctor W. Clyde McClelland, and my brother, Doctor Gilbert W. Campbell; the former has rendered invaluable assistance in the development of technic and has kindly read both manuscript and proof; the latter has edited this volume—without his assistance its publication would never have been undertaken.

DAYTON DUNBAR CAMPBELL.

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## CONTENTS

CHAPTER I

CHAPTER III



CHAPTER IV

CHAPTER XII



CHAPTER XIII



CHAPTER XIV

CHAPTER XVII



CHAPTER XVIII



CHAPTER XIX

# FULL DENTURE PROSTHESIS

## CHAPTER I

### DETAILED TECHNIC IN THE CONSTRUCTION OF MAXILLARY AND MANDIBULAR FULL DENTURES

(This chapter is intended by the author as an aid to those who wish to follow in detail a definite technic from impression-taking to final insertion of the finished dentures.)

**The Purpose of This Chapter Is to Furnish a Detailed Guide.**—The purpose of this chapter is to present a detailed technic of the construction of maxillary and mandibular full dentures in vulcanite. The construction of vulcanite dentures is selected, not because the author prefers vulcanite or thinks vulcanite dentures are superior to others; on the contrary, he regards vulcanite dentures as inferior to all others with the exception of those made of celluloid. Neither is the technic of constructing vulcanite dentures regarded as more simple than that employed in constructing metal base dentures. However, vulcanite dentures are, as yet, more familiar to the average dentist, and their construction lends itself to a more continuous presentation of technic than is possible in describing the process of constructing metal base dentures.

This chapter endeavors to present the technic of full denture construction so clearly and definitely that any dentist, or student of dentistry, who familiarizes himself with the ordinary terms employed in prosthetic dentistry, may employ this chapter as a manual or handbook. The author believes that it may be followed in detail without hesitation in the construction of satisfactory dentures. Of course, the experienced technician will have the advantage in many respects of the technician whose experience is limited. While the experienced traveler may journey in ease and enjoy greater comfort, his certainty in arriving at his destination need not be more secure than that of his inexperienced comrade, who is making his first tour. In fact, the inexperienced traveler will be more certain to follow his guidebook,

and will not be tempted to risk short cuts or side journeys, nor will he be likely to miss connections through overconfidence in schedules which served on a former tour, but, which the experienced traveler fails to note, have since been changed.

**This Chapter Assumes an Ideal Patient.**—It is assumed in this chapter that the patient for whom these dentures are constructed is of the type closely approximating the ideal from the prosthetist's viewpoint. In other chapters, suggestions will be given concerning types which


Fig. 1.—One-piece aluminum impression tray (maxillary).

are not so nearly ideal. The patient of this chapter is assumed to be of mature age, in good health, with large and symmetrical ridges, with the overlying tissue of the ridges in healthy condition and possessing some resiliency.

**Size of Tray Is Determined by Trial.**—The edentulous patient seated in full upright position with head firmly against the headrest of the operating chair, is provided with bib towel while the operator thoroughly washes his hands. The size of the tray to be used is determined by trial. One of the three sizes—S. S. White's aluminum impression trays Nos. 102, 104, 106—should be selected (Fig. 1) which is slightly larger than the ridge rather than of exact size, or possibly

too small. The trays are dipped in warm water for a moment to remove the chill before trying them in the patient's mouth.

**Making Individual Impression Tray.**—The aluminum tray is employed merely as an aid in fashioning an individual impression tray of compound. Two cakes of S. S. White's impression tray compound


Fig. 2.—S. S. White's impression tray compound.

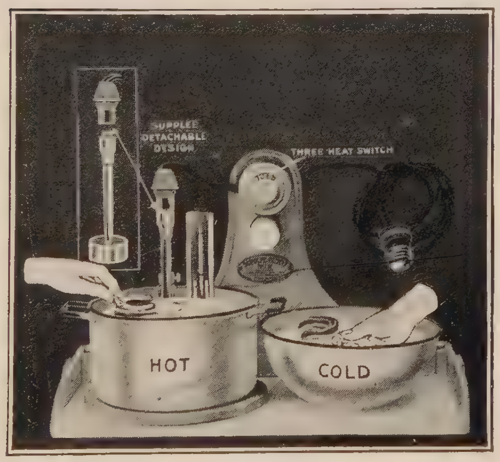



Fig. 3.—Supplee unit used in heating impression tray compound.

(Fig. 2) are placed in a pan of water which is slightly hotter than can be borne by the hand (about 160° F.), and the pan immediately removed from the flame. However, if the Supplee heater (Fig. 3) is used, the temperature will be maintained without further attention or danger of overheating. The S. S. White's black impression tray

compound is especially suitable for the purpose of making the individual impression trays, because the temperature required to render it plastic is sufficiently greater than that required for the Kerr's compound used in conjunction, to make it possible to apply the Kerr's compound upon the black S. S. White's compound and then reheat the Kerr's compound without distorting the underlying black compound. Furthermore, the black compound may be cut with a sharp knife almost as if it were soft pine. When the two cakes of compound are placed in the water, if they are not placed one upon the


Fig. 4.—Impression tray compound level with sides of aluminum tray.

other, both will quickly, possibly within a minute, absorb enough heat so that they may be molded easily into the metal tray. The compound should be kneaded only enough to fold the wrinkles underneath and thus leave the surface smooth. Immediately previous to putting it into the tray, it should be held with the wrinkled surface in the flame for a moment so that the mass will adhere to the dry tray. Pull the edges of the mass down over the tray and cut off with a pressure of the fingers against the edge of the tray, leaving the surface of the compound level with the sides of the tray (Fig. 4). The mass will now adhere tenaciously so that it may be inverted over

the flame and the entire surface superheated. The superheated surface of the compound is now dipped in hot water and immediately removed ready for inserting in the patient's mouth. The purpose of immersing in the hot water is to "temper" the superheated surface in order to avoid burning the patient.

**Inserting the Tray.**—Standing behind and slightly to the right of the patient, the operator employs the thumb and one or two fingers of the left hand to open and distend the left side of the mouth and cheek, while the right hand holding the handle of the tray conveys the tray of compound by inserting first the right posterior buccal portion (Fig. 5), and with a rotary movement bringing the left posterior buccal portion into the mouth. When the hole in the handle of the metal tray is held in the median line, the tray will properly extend

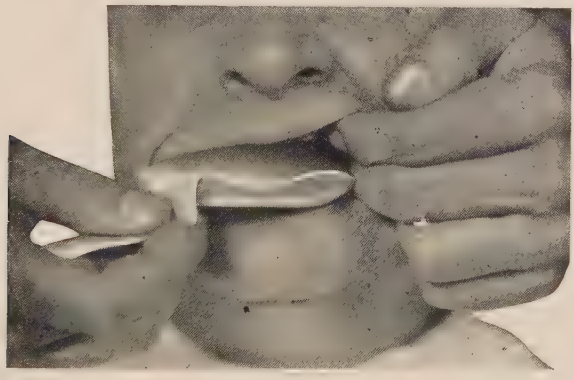
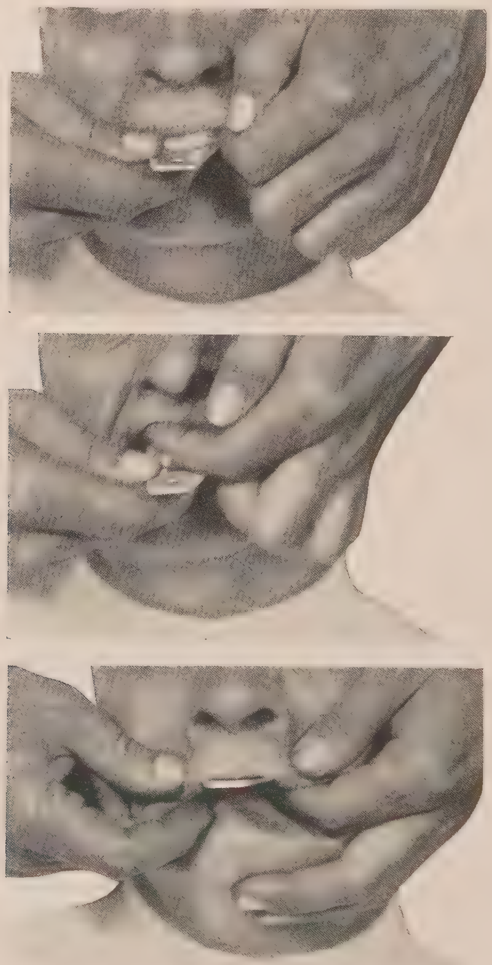


Fig. 5.—Inserting the tray of compound. The mouth is not open extremely wide.

over the vault and ridges; when the crest of that portion of the ridge which once held the six maxillary anterior teeth. is midway between the raised palatal portion of the tray and the labial flange, the tray will be in proper position anteriorly and posteriorly. The index and middle finger of each hand are placed upon the bottom of the metal tray, the index fingers resting upon each side under the region corresponding to that of the cuspid, the middle fingers under the regions corresponding to those of the second molars. In changing the hand from the handle of the tray to assist in supporting by means of both index and middle fingers, the index of the left hand is moved along beneath the lip in order to gently lift it and bring it over the labial flange of the tray (Figs. 6 and 7). The thumbs are employed (while the fingers hold the tray in position) to press the excess further down over the buccal and labial borders of the tray (Fig. 8).

Often the operator will find that the excess compound along the posterior border is beginning to encroach upon the soft portion of the palate. He will save the patient from a great deal of annoyance, if he will use a mouth mirror to draw this excess forward and upon the



Figs. 6, 7 and 8.—Illustrating different positions of the thumbs and fingers, from seating the impression tray compound to massaging the lips and checks.

metal tray. The suggested position of the fingers will bring the operator to a position directly behind the patient; the tray of compound is pressed into place with a movement which is a combined upward and posteriorly directed movement, that is, the movement is

in the direction of the patient's ears rather than directly toward the top of his head (Fig. 9). When hard, it is removed.

**How Much Pressure Is Required?**—The pressure required to press the compound into place will be in inverse ratio to the pliability of the compound. In other words, the warmer the compound, the less the pressure that will be required. Pressure should be exerted and continued until any excess of compound flows over the flanges of the metal tray. This excess will often begin to distend the cheeks.

**When Impression Is Not Acceptable.**—It is more desirable that this improvised compound tray shall be too thick in the palatal portion

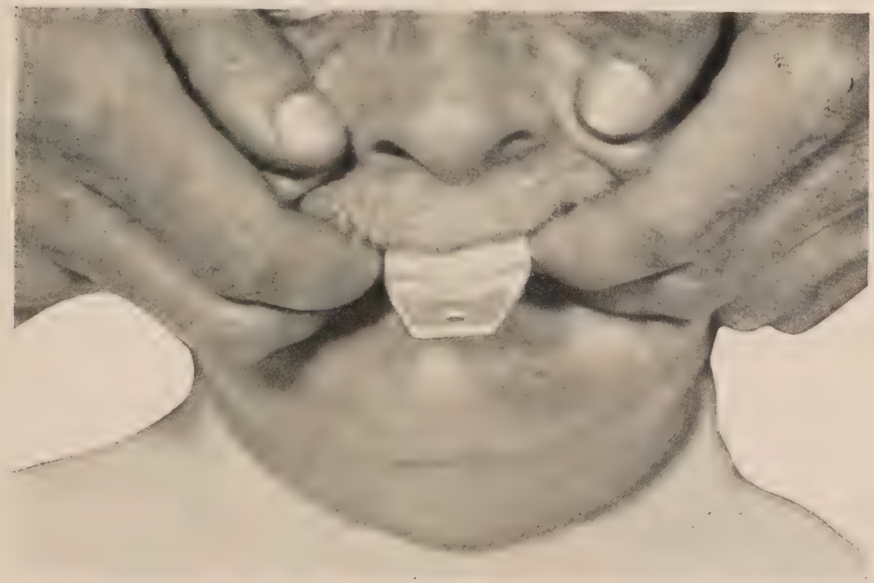


Fig. 9.—Pressure is directed toward the patient's ears rather than directly toward the top of his head.

than too thin. In fact, if, when the tray and compound are removed from the mouth, the metal tray shows through the compound, the operator should begin again from the first step. If the metal tray is visible through the compound the operator may know that the amount of compound has been insufficient, or that too great pressure was employed. On the other hand, if the compound is not sufficiently heated before inserting in the mouth, or if the pressure exerted is not sufficient to secure an impression which shows some distention of buccal and labial tissues, it will be equally necessary to remove all of the black compound from the metal tray and, after reheating in the hot

water, kneading, applying to the tray, leveling, superheating the surface, immersing in hot water, to insert in the mouth and secure another impression. When removed from the mouth it is placed in cold water.

**A Wire Strengthener Is Provided for the Mandibular Tray.**—The metal tray (Fig. 10) for the mandibular impression will be selected from S. S. White's aluminum impression trays Nos. 101, 103, 105. The one suitable for the case will be sufficiently large to extend labially and buccally over the ridge and posteriorly to include the

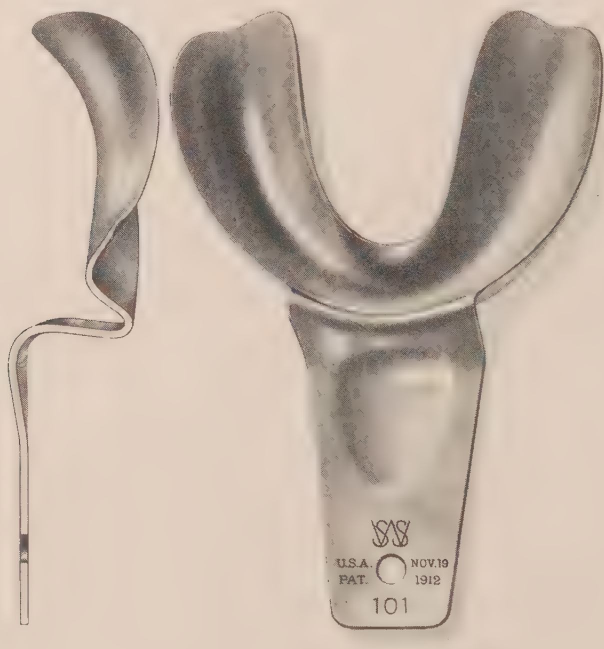



Fig. 10.—One-piece impression tray (mandibular).

full length of the ridge. Quite frequently it is necessary to bend the flanges of the tray to provide more room for the tongue, and occasionally a flange must be bent away from the mylohyoid portion of the ridge. On account of the shape of the mandibular tray, there is more danger of fracturing an individual tray fashioned of compound than there is in the case of the maxillary. Accordingly, a strengthener (Fig. 11) is provided by means of a piece of soft iron wire, about eight gauge, or three millimeters in diameter. This piece of wire is bent to tray form, flattened upon the anvil, and afterwards contoured more exactly to lie along the inner portion of the metal tray; it

should lack at least twenty-five millimeters of extending to the extremity of either heel (Fig. 12). A small number of these in three different lengths will be sufficient for several years' practice, since they may be used repeatedly.

One and one-half cakes of S. S. White's black impression tray compound is usually sufficient for the mandibular impression. After heating, as in case of the maxillary, it is formed into a roll which will fill the metal tray. This is now laid in the tray upon the wire

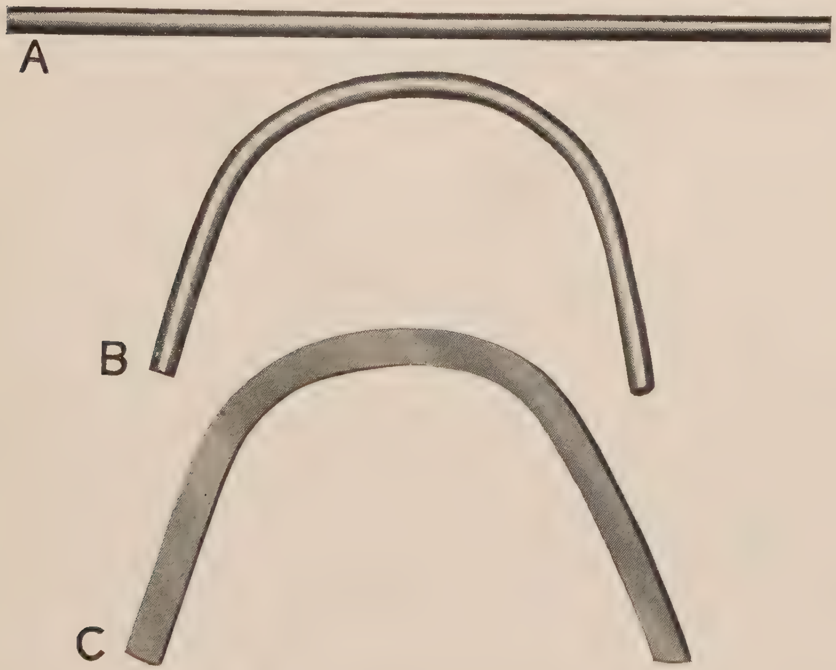



Fig. 11.—Wire strengthener for mandibular individual tray. *A*, Length of soft iron wire; *B*, bent to tray form; *C*, flattened and contoured.

strengthener, which a moment before has been placed in the tray with the pliers, after being heated in the flame hot enough to incorporate itself readily in the tray compound which is placed upon it. The excess of compound is cut off of the tray by pressure of the fingers.

**Making the Mandibular Impression Tray of Compound.**—In taking this impression the operator will find it convenient to seat himself in front and to the right of the patient (Fig. 13). The tray of compound is inverted over the flame, immersed in hot water, the excess water thrown off, and the tray in this inverted position carried to

the patient's mouth. With the patient's mouth open, but not wide enough to keep the operator from distending the lips and cheeks, the operator, with the forefinger of his left hand, distends the right corner of the mouth and with a rotary movement introduces the right portion of the inverted tray and brings it into position over the ridge. Remaining seated, the operator places either the index or middle finger of each hand upon the top of the tray, when, with the thumbs beneath the mandible acting as the lower parts of a clamp (Fig. 14), the tray with its compound is pressed down into place.


Fig. 12.—Wire strengthener lacks at least twenty-five millimeters of extending to either heel.

When the tray is in place, the thumbs are moved upward massaging the labial border (Fig. 15); as the thumbs are thus employed, the patient protrudes his tongue (Fig. 16). The excess of compound along the lingual border is often displaced by this protrusion, while the operator, maintaining a slight pressure upon the tray, employs the thumbs to massage the cheeks and lips until the excess compound is displaced upward and the peripheral border is made thin enough to avoid distending the cheeks and lips.

The impression may be left until cool enough to remove from the

mouth without distortion, or better,—and with the patient's comfort especially considered,—the saliva ejector is introduced and the impression chilled with cold water. It is then removed, washed clean of saliva and left in cold water while the operator returns to the maxillary impression.

The metal tray is removed from the improvised tray thus formed. It is removed by first breaking away the excess portions which were turned back over the bottom and sides of the tray. When these are removed, the metal tray (if it is perfectly clean and polished as it should have been before using) may be removed easily.

Fig. 13.—The operator is seated while taking the mandibular impression.

**Trimming Away the Excess of Compound.**—With a *sharp* knife, since the pressure necessary with a dull one may cause a fracture, the improvised black compound tray is shaped to the desired form. The desired form is the picture which the operator has in mind of the tissues of the mouth. If he bears in mind the fact that these tissues must not be unduly distended by the finished denture, he will have a guide in trimming the improvised black compound tray. To avoid fracturing the compound, the operator cuts away the surplus compound with a cutting movement almost parallel with the sides of the improvised tray. The buccal and labial roll is cut away up to a line along which the roll begins to turn outward. This line along which the roll begins to turn denotes approximately the lowest point

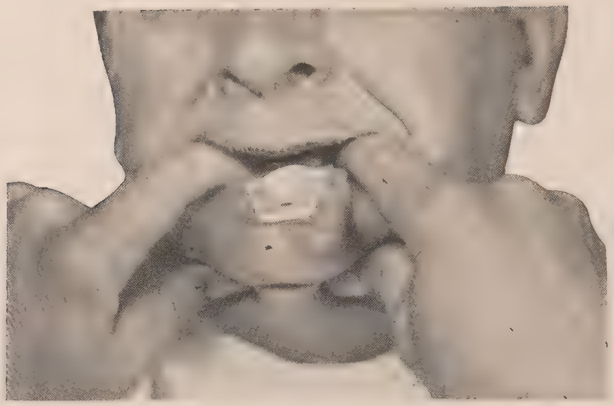


Fig. 14.—Thumbs and fingers serving as clamps.

Fig. 15.—When the mandibular tray is well-seated, the thumbs are moved upward in massaging the labial border.

Fig. 16.—As the thumbs massage the labial border and move upward the patient protrudes his tongue.

of attachment of the movable tissue (Fig. 17). When the compound was pressed to place in taking the impression, this tissue was somewhat, even if but slightly, distended. Accordingly, when the compound is trimmed to this turn of the roll, the operator is certain that at no point will the peripheral border of the finished denture be too high. It may not be high enough, and in most places will not be high enough; certainly, the border will not be adapted closely enough.

Height, peripheral adaptation and a seal against the ingress of air will be assured through proper use of Kerr's stick compound (Fig. 18), and black carding wax, which use we shall presently describe.

After cutting the buccal and labial flanges of the improvised compound tray as described, the tray is shortened at the posterior border

Fig. 17.—Maxillary and mandibular compound impressions, showing the results of trimming to shape for use as individual trays. The white thread lines indicate limits to which trimming is continued. The whitened spot on the mandibular indicates the portion that should be cut out so as to avoid pressure upon the mylo-hyoid ridge.

along a line which is within a few millimeters of the junction of the hard and soft portions of the palate.

The portion of the compound tray which touched the palatal portion of the metal tray is now concaved or hollowed out as if the operator intended to contour and make this tray the very base of the finished denture. That is, the hollowing-out process provides ample room for the tongue, without cutting the compound so thin as to sacrifice strength (Fig. 19). The borders are gently scraped and made smooth with the knife.

A hole, approximately four millimeters in diameter is cut at the juncture of the median line with the impression of the ridge (Fig. 20). Whether the hole is cut a few millimeters posteriorly or anteriorly

is immaterial. This hole will permit the impression to seat properly; it prevents the improvised tray, when inserted in the mouth, from creating a vacuum and thus being retained by atmospheric pressure. (Cf. Chapter II, Psychological Phases of Full Denture Prosthesis, page 133.) This is the primary object in providing the hole, but it will also later permit the escape of plaster, when the impression is being completed with that material.

**Determining the Length of the Tray.**—An easy, and at the same time a very dependable method of determining the correct length of the tray—which in turn results in a denture properly extended upon the soft tissues at the junction of the hard and soft portions of the


Fig. 18.—Kerr's stick compound.

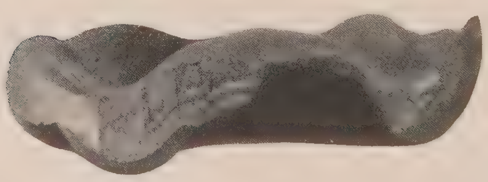


Fig. 19.—Showing posterior palatal portion of improvised tray as it is hollowed out in removing excess bulk. Portion to the left of median line has not yet been hollowed out.

palate—is that suggested by Dr. Claude J. Stansbery of Seattle. Following his method, the operator will trim the posterior palatal border of the improvised impression tray so that it will present a sharp margin. This margin is marked with an indelible pencil. The tray is then inserted and the patient requested to blow through the nose. This is rendered impossible because the operator holds the nostrils tightly together. The effort on the part of the patient tends to lower the soft portion of the palate, bringing it into contact with the indelible pencil mark. The pencil mark is thus transferred to the tissues which now register the point to which the tray extends. Whether this is the desired length or not is then determined after

the tray is removed. The patient is requested to say, "Ah." As he does this, the operator observes how great the distance is between the junction of the hard and soft portions of the palate, and the pencil mark. The tray is shortened (or lengthened if this should be necessary) until it extends at least one or two millimeters upon the soft tissues.

**Using Kerr's Stick Compound.**—The operator now removes the improvised tray and is ready to provide peripheral adaptation, give proper height and assure seal against ingress of air. Kerr's stick compound is penciled upon the black tray compound, for this purpose. After drying the black tray thoroughly with a soft towel or napkin, one end of a stick of the compound is held in the flame and rotated until it becomes so soft that the rotary movement is neces-

Fig. 20.—A hole, approximately four millimeters in diameter, is cut at the junction of the median line with the impression of the ridge.

sary to keep a portion from dropping off. It is then applied to the posterior buccal border on one side (Fig. 21). With the bulk of this application on the posterior buccal border, a portion is penciled down upon the extreme posterior border in the direction of the palatal portion of the tray, allowing a very light application to attach itself to the posterior palatal border. This compound is also extended forward on the crest of the border up as far as a point corresponding to the buccal frenum. The Kerr's compound thus provided will be in position to receive an impression of the most distal portion of the tuberosity,—if there is one—and if there is no tuberosity, then of that portion of the ridge which loses its identity at this point. In many instances a sufficient bulk of compound should be added to fill the space between the tissues covering the coronoid processes and the

tuberosities. Whether this is needed may easily be determined when the impression is removed. If at these points there is no indication that the tray compound has come into contact with the tissues, Kerr's compound should be added. Failure to assure contact will result in failure to prevent the ingress of air in this region.

The black improvised tray thus supplied with the red Kerr's compound is held in cold water for a moment. This is necessary because

Fig. 21.—Penciling the Kerr's stick compound upon the improvised tray.

Fig. 22.—The author's method of projecting the flame.

the red compound will be too hard in the thinner portions and too soft where it is thick. After chilling, the portion of tray supplied with red compound is dried, first with the towel and then any moisture that cannot in this way be reached is blown out with air from the chip blower. The chip blower is then used to project the gas or alcohol flame against the red compound (Figs. 22 and 23) until it is everywhere hot enough, after being dipped in hot water to avoid burning the patient, to receive an imprint of the tissues. The im-

provised tray thus supplied with the Kerr's compound is now inserted, pressed to position, and held firmly with one hand while the fingers and thumb (and often that portion of the palm at the base of the thumb) grasp the corner of the mouth and pull the cheek down and forward and in, massaging against the border of the impression, finally holding it in this position for a moment (Fig. 24). The case is chilled with a stream of cold water and removed. The operator

Fig. 23.—The Tench mouth blow-pipe for projecting the flame.

need not be afraid of pulling the softened compound down too far while he is engaged in massaging the cheek with this down-forward-in movement in determining the height of the border in the *region of the tuberosity.*

The technic for adapting the Kerr's stick compound upon the posterior border is the same for both right and left sides, except that the operator, if ambidextrous, will use his right hand in massaging the right side and the left hand for the left side. If he can use skill-

fully but one hand, e.g., the right hand only, he will need on the left side to modify this technic accordingly.

After one section of the tray is provided with the Kerr's stick compound, the corresponding section on the opposite side is then

Fig. 24.—Massaging the compound along a posterior buccal border of the maxillary impression tray.

Fig. 25.—Massaging compound of the labial and anterior buccal border of the maxillary tray.

dealt with, in order that the impression may more equally distribute the pressure.

When the posterior portions have been properly adapted, the Kerr's compound is next traced along the buccal border from the buccal frenum to the median line. When heated and dipped in hot water, as previously described, this border is adapted in the following manner. The lip is grasped between the forefingers and thumb of one

hand and held in position over the anterior labial portion in the region of the cuspid eminence (Fig. 25). While the lip is thus held in position, the thumb is used to massage toward the median line and alternately in the opposite direction. The operator thus palpates with his thumb the border of the impression beneath the lip. The pressure from the outside adapts the border against the ridge. Occasionally, as a result of this massaging, there is an excess of compound in the region of the buccal frenum and another portion near the median line. After the tray is removed and chilled the operator cuts this excess away rather than attempt to warm again and endeavor to conform to the border of the tray.

The operator now devotes for a time his attention to the region of the border near the buccal frenum at which place the two sections are joined. This joining requires a re-warming by means of a flame

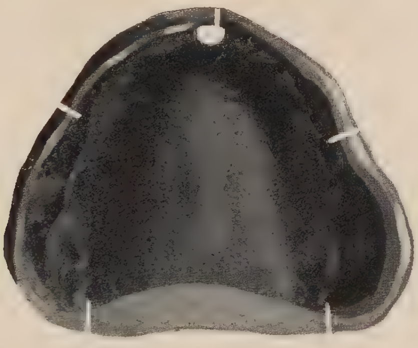


Fig. 26.—Improvised tray after Kerr's stick compound has been adapted to the five sections of the periphery.

directed by the chip-blower, a return to the mouth, and a massaging in this region to establish the relation of the buccal frenum to the border of the tray. The appearance of the sections of the border around the frenums of right and left sides will seldom if ever be symmetrical. Often there is no evidence in the impression that a buccal frenum exists, and not infrequently it is in fact nonexistent. In order that there shall be no impingement when the final impression is taken with plaster, the labial frenum is provided for by cutting away enough of the tray in depth at this point to prevent it.

When the two sides of the improvised black compound tray have thus been adapted, the operator is ready to trace some of the Kerr's stick compound along the posterior palatal border in order to supply any deficiency of black compound here that may be noted (Fig. 26). Occasionally, the operator may find that the improvised tray is not

too long but too short. If too short, the palatal portion may be lengthened by means of the Kerr's compound, heated, dipped in hot water and adapted in the mouth by pressing to position.

**Black Carding Wax Wire Equalizes Pressure Along the Whole Border.**—In order to equalize the pressure over the whole border of the impression, the operator employs a small roll of black carding wax about 8 gauge or three millimeters in diameter. In view of the fact that the border has been supplied in four sections, as previously described, it is probably obvious to most readers of this text, that only the very expert operator will have succeeded in adapting these four sections individually so as to secure a balanced border pressure throughout. Therefore, the use of this roll of carding wax affords ease and certainty for both the skilled operator and the novice. This

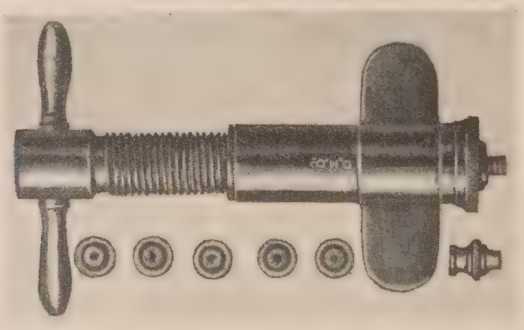


Fig. 27.—Marthew's sprue former used in making wax wire.

wax wire is made of the black carding wax upon which the manufacturers supply the teeth. It should be clean and, when warmed, it is placed in Marthew's sprue former (Fig. 27) and forced through the opening which makes the largest possible sprue. This black wax wire is attached to the lower inner portion of the posterior buccal border of the improvised impression tray and brought forward on a level with a line two or three millimeters below the crest of the border up to the labial frenum; here it is cut off and with a hot spatula its entire length is sealed to the tray. The other side of the tray is supplied in like manner (Fig. 28). The tray is now held over the flame and rotated in such way as to warm this wax wire throughout its length, or it may be warmed by means of the flame and chip-blower. It is then flattened by compressing it and the tray between forefinger and thumb. It is again warmed in similar fashion as before; the tray is then carried to the mouth and, with fingers beneath

as previously described in connection with pressing the metal tray and compound into position, the improvised tray is pressed up into position, directing the pressure in a way which would be parallel with the long axes of the patient's teeth—if he had any. This pressure is maintained for a few moments and the tray is then removed.

Evidence of the value of this use of the carding wax wire may be found upon examining the tray. The examination will disclose the fact, that at some points the wax wire is thicker than at others, while at other points it is thin enough to expose the underlying compound. This indicates that at points where the underlying compound does not show through, the adaptation might have been closer, while at those points where the wax wire is thinned out, the border was properly adapted; its use is thus shown to be effective indeed.

Fig. 28.—Carding wax wire as it extends from the tuberosity on each side to the frenum.

**''Post-damming'' Becomes Almost Automatic.**—The carding wax is also employed for an additional purpose, namely, for ''post-damming.'' Post-damming is the term employed to describe the act of slightly depressing the tissues at the junction of the hard and soft portions of the palate. A piece of the carding wax is warmed and formed into a roll about six or seven millimeters in diameter in the middle and tapering to two or three millimeters toward the ends; its length varies with requirements due to the size of the case, but it should extend from one tuberosity to the other and join the carding wax wire which was previously supplied along the border on each side (Fig. 29). This carding wax for post-damming should be placed upon the improvised compound tray slightly anterior to a position corresponding to the position of the junction of the hard and soft portions of the palate.

After placing the wax roll, it is flattened between the thumb and forefinger, until it is not more than one-half as thick as the original diameter. It should not, when placed in position, extend over the posterior border of the tray. After being warmed slowly and thoroughly by means of a flame projected against it, it is carried into the mouth and, with the anterior portion seated as well as possible, the posterior portion is brought up with firm pressure and held firmly against the tissues for at least one minute.

**The Character of This Black Carding Wax is a Significant Factor.**—The idea which prompts the use of this carding wax is that the character of the wax is such as to depress in automatic fashion the soft tissues at the junction of the hard and soft portions of the palate—

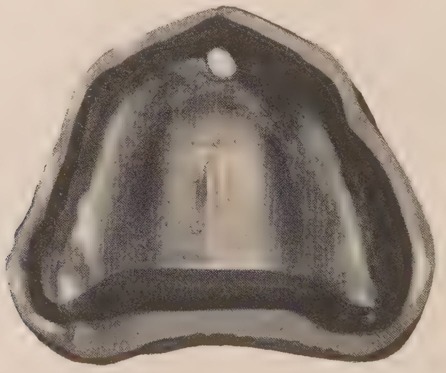


Fig. 29.—Carding wax roll used in post-damming extends from tuberosity to tuberosity and joins the wax wire previously supplied.

depress them slightly and at the same time spread out over the hard portion of the palate without undue compression. To be more specific, there are areas in the hard portion of the palate which compared with other portions in this same hard portion are relatively soft; the position of these areas varies in different mouths. Among these soft areas there will usually be the soft areas over the posterior palatine foramina.

The black carding wax employed as suggested in the technic just described, together with the hollowing out of the black compound tray, (as indicated in the next paragraph) so that, in taking the final impression, these soft areas will be covered with plaster—removes all possibility of compressing soft areas to such an extent that nerve and blood supply will be impaired sufficiently to cause atrophy. It may be

well to call attention to the fact that the hole in the tray permits the free escape of plaster so that tissues are not unduly compressed by the plaster.

**Portions of Tray to Be Cut Out.**—With a sharp knife that portion of the compound tray occupied by the ridge during impression-taking, and also the portions over the posterior palatine foramina, are cut out to a depth of three or four millimeters, more or less, more, if the mucoperiosteal tissue of the mouth is pendulous or flabby, less, if it

Fig. 30.—Position of patient ready for finishing the impression with plaster.

is hard and tense. This portion of the compound tray is cut out in keeping with the theory that when it is cut out, the tray will not bear upon the extreme crest of the ridge, when the plaster impression is being taken, and furthermore that the base may not bear upon the extreme crest of the ridge while the denture is being worn. In cutting out the portions mentioned, the posterior portion of the raphe, or hard portion of the palate, is retained so that the impression may have a seat when pressed to position, inasmuch as all of the area covered by the rugae has been cut away to receive the plaster. It is

true also, that a better impression of this area can be taken with plaster.

**The Impression Is Completed With Plaster.**—In completing the impression in plaster (the use of the compound in forming an individual impression tray for each patient is always with a special view to taking the final impression with plaster), the patient is provided with a waterproof bib apron and instructed to sit with feet resting squarely on the footboard of the chair and with the elbows on his knees, thus bringing the head forward and down (Fig. 30). Instruction is given the patient regarding the desired position so that he may be ready to assume it when the operator is ready with the plaster.

**Mixing the Plaster.**—Water at room temperature is put into a large size plaster bowl and an equal amount of a saturated solution of potassium sulphate is added. Any good impression plaster may be used, but the author prefers Kerr's Snow White impression plaster because of its constant character; plaster from one barrel or can sets as quickly as that from another. In mixing it, the author follows Dr. Hall's method of mixing plaster. Place the proper quantity of plaster in a dipper sieve (Fig. 31) of a size smaller than the plaster bowl. Hold the sieve over the bowl and tap the rim with a spatula, thus sifting the finely divided plaster into the water. Sift the plaster into the water as fast as it will sink and when the desired amount has been sifted in, pour off the free water until a small portion of the plaster starts to flow over the side of the bowl. It should then be stirred for a minute or two, depending upon temperature of water, the accelerator, and bulk of plaster. When spatulated sufficiently, three or four times as long as required for most other plasters, it will gradually thicken. When this is spatulated, it will assume very quickly a cream-like consistency and soon begin to set. Those who have never used Kerr's plaster will, even while trying to mix it thin, allow it to thicken until the superior feature of this plaster is lost, namely, the possibility of manipulating it for a comparatively long period of time after it begins to set. When the plaster has assumed the consistency of thin cream, the improvised tray is supplied with about two teaspoonfuls—or an amount sufficient to replace the portion of the black compound which was cut out in order to receive it. This plaster is flowed over the palatal and ridge portion and up along the border to the black carding wax. In putting this in the palatal and ridge portion, the placing or flowing of the plaster may be considered, as sug-

gested above, as an attempt to fill approximately the portions cut out of the compound tray.

**If the Posterior Border Is Pressed to Place First, the Plaster Will Be Forced Out of Hole in Anterior Portion.**—With the patient seated in the position described, the improvised tray with its plaster is inserted in the mouth with thumb and forefingers. Ordinarily no attention is paid to the hole in the tray, because, as a rule, the weight of the plaster is not sufficient to cause it to run out. If the operator is manipulating a very thin mixture of plaster, he may put one finger over the hole until he begins to bring the posterior border up into

Fig. 31.—Dipper sieve for sifting plaster.

position against the vault of the mouth. The posterior border is brought up to position first so that the flow of plaster and pressure will be directed toward the anterior portion of the tray. When the anterior portion is brought into position, the excess of plaster literally spurts through the hole provided in the tray and runs out of the patient's mouth as the head is inclined purposely to permit this. With the tray held firmly in position, the operator brings the patient's cheeks and lips into normal position.

**Removing the Impression.**—As soon as a small portion of the plaster may be broken—or may no longer be mashed—the tray is released and preparations are made to remove it. The patient is given a glass of

water and the operator demonstrates by a movement of his own lips and cheeks the method by which he wishes the patient to force a mouthful of water into all parts of the mouth; he demonstrates by blowing somewhat as a bugler blows with cheeks and lips distended (of course, however, with lips closed) or with a movement of cheeks and tongue such as one is accustomed to employ when rinsing the mouth.

After the impression has been removed and all traces of plaster removed from the patient's face, the impression is washed in running water to cleanse it of saliva and to remove any loose particles of plaster. It is then laid aside until the mandibular impression is completed.

**Relation of Plaster to the Black Carding Wax as a Measure of Perfection.**—The impression approaches perfection when there is sufficient plaster to fill the intaglio of the tray without encroaching upon the black carding wax. A slight wash of plaster upon the black carding wax would still warrant a judgment of 95 per cent, on a basis of 100 per cent for the perfect impression. If the posterior portion of black carding wax has only a slight wash of plaster upon it, while the wax in the anterior portion of the tray has been entirely covered up with plaster, the grade would be perhaps 90 per cent; while to cover both anterior and posterior portions would signify that the carding wax was employed without result and that such an impression would warrant a grade of 80 per cent. However, this 80 per cent rating, since it is applied to an impression taken in an individual impression tray, is probably indicative of an impression which is 50 per cent better than the impression which is too often taken with plaster and metal tray alone.

**Trimming the Mandibular Compound Tray.**—The mandibular compound tray is now removed from the water and divested of its metal tray in somewhat similar fashion to the method employed with the maxillary tray. The buccal, labial and lingual flanges are now trimmed (see Fig. 17). The lingual flange is trimmed and smoothed until when tried in the mouth with tongue brought forward barely into contact with the upper lip, there is only a slight tendency to displace the tray. The buccal borders are cut away and smoothed so that when the mouth is opened about as is natural in taking food, and as the operator with thumb and forefinger grasps the corner of the mouth and raises the cheek, it is noted that this lifting of the buccal tissue tends to raise the tray, or displace it, only very slightly. The labial

portion is trimmed until the lip is not distended when the tray is pressed down into position on the ridge.

**Kerr's Stick Compound Is Supplied to the Mandibular with Technic Similar to That Employed with the Maxillary.**—The improvised mandibular impression tray from which all excess of black compound has been cut away with a knife, as described in the preceding paragraph, is now ready to be supplied with Kerr's stick compound in order further to trim, or lengthen, automatically the border as may be required. The technic for the mandibular impression is the same as that followed in the case of the maxillary, insofar as drying the tray, heating and attaching the Kerr's stick compound are concerned. It is preferable to pencil the compound upon, and automatically trim, the *buccal* and *labial* borders before the lingual is treated, because the extent of the lingual flange is to be determined largely by the protrusive action of the patient's tongue. If the buccal and labial borders are properly adapted, the improvised tray will remain in position more securely when the tongue is raised during the automatic trimming operation. In describing the action of trimming as "automatic," the author has in mind the fact that the action of the muscle attachments of the tongue upon the softened compound shortens the tray most satisfactorily. Shortening the tray by this method is more acceptable than the method of shortening it with a knife according to each operator's idea of the requirements.

**The Left Mandibular Buccal Flange Is the First Portion Treated.**—A portion of the tray is supplied with the Kerr's stick compound; the tray is then immersed in hot water to avoid burning the patient, and then inverted. The left mandibular buccal flange is the first portion of the lower to be treated. This portion extends from the region of the cuspid posteriorly to the extreme portion of the heel and up to, and barely over, the crest of the ridge. After inverting the tray, it is held firmly in position with the fingers of the left hand, while the cheek is grasped between the fingers and thumb of the right hand and drawn forward and pressed in over the ridge (Fig. 32). The thumb during this process is inside the cheek. As a result of this operation, the tray will be shortened automatically and thickened, particularly in the region of the extreme posterior portion. Usually, after chilling, the thickened portion must be trimmed away and the operation repeated. In treating the right mandibular buccal flange, the fingers of the left hand press the cheek over the tray, while the fingers of the right hold it in position on the ridge (Fig. 33).

Fig. 32.—Treating the left buccal flange of the mandibular impression.

Fig. 33.—Treating the right buccal flange of the mandibular impression.

Fig. 34.—Shaping the labial portion of the mandibular impression.

**The Labial Portion Is Treated in One Section.**—The remaining or labial portion may be taken care of in one section. This section, after the Kerr's compound has been applied, is placed in position and held with the forefingers of both hands, while with the thumbs the lip is massaged upward to normal position (Fig. 34). The tray is removed and chilled, and any inequalities or irregularities are noted and corrected by adding or removing Kerr's compound.

**The Only Assistance Requested of the Patient Is a Protrusion of the Tongue.**—A portion of one of the trimmed lingual flanges extending from the heel to the cuspid region is next supplied with the penciled compound. The compound should join the compound which has already been applied to the buccal flange; this will necessitate a line of compound which extends across the border of the heel from the buccal flange across to the lingual flange. This is placed in position and while held

Fig. 35.—Wax wire in position to secure peripheral adaptation of the impression of the mandible.

in place, the patient is asked to protrude the tongue and touch the upper lip. As a result of this protrusion the lingual border will, in the majority of instances, be shortened somewhat and its thickness increased; the shortening and thickening will depend upon the temperature of the compound, the height and size of the lingual attachments in the floor of the mouth, and to the extent to which the tongue is protruded. The other lingual flange is corrected in a similar manner.

Kerr's stick compound is applied to the remaining portion of the flange, is superheated, dipped in hot water, and seated upon the ridge. The patient is requested to bring the tongue forward to rest upon the upper lip; this action automatically raises the warm compound to a height which will be the height of the finished denture.

**The Black Carding Wax Wire as Applied to the Mandibular.**—The black carding wax wire of the same size as that employed in the maxil-

lary region is attached at the heel along the inner border of the lingual flange just below a point corresponding to the crest of the ridge. The wax then follows along the inner edge of the buccal flange of the improvised tray as near to the edge as possible, without permitting any of the wax to extend out so far that it can be seen when the tray is

Fig. 36.—Using forefingers and thumbs in compressing black wax of mandibular individual black compound tray.

Fig. 37.—Cutting off the excess plaster of the mandibular tray while stabilizing it.

viewed occlusally. The wax along this border extends from the inner border of the lingual flange at the heel and along the buccal flange of one side entirely around the tray and ends at a point on the remaining side corresponding to the point of beginning (Fig. 35). A small portion of this black carding wax wire is placed on the lingual border at the median line and allowed to extend fifteen millimeters on each side of

this line. Further extension should be avoided and thereby pressure upon the mylohyoid ridge will be avoided. In most instances it is wise to trim away the compound inside the lingual flange in order to be certain that there shall be no impingement. (See Fig. 17.) The wax along its entire length is sealed with the use of a hot spatula; it is then warmed, and with the fingers is flattened to half of its original diameter,

Fig. 38.—Finished impression of the mandible.

Fig. 39.—Finished impression of maxilla.

against the improvised tray. The wax is again warmed; the tray is then placed in position in the mouth and held with light but even pressure against the ridge by clamping between the thumb and fore-fingers, the thumbs being placed beneath the mandible and the fore-fingers upon the top of the tray (Fig. 36).

**The Quantity of Plaster Required Is Determined by the Amount of Compound That Was Cut Out.**—The inner portion of the tray, the ridge portion between the two lines of black carding wax, is cut out

to a depth of three or four millimeters to accommodate the plaster, which is now mixed, as previously described for the maxillary impression, and placed in the tray. The quantity of plaster used approximates the quantity of black compound which was cut out. The plaster will adhere sufficiently to permit the operator to invert the tray and carry it into the mouth, where it is pressed firmly to position and held until the plaster has set. As the tray is pressed to position, the patient is requested to extend his tongue until it is slightly protruded against the upper lip. This action of the tongue wipes off the excess of plaster from the lingual border of the tray; the excess of plaster along the buccal and labial borders is turned back over the tray by the thumbs and fingers of both hands (Fig. 37).

Not infrequently it may be necessary for the patient to employ a mouthful of water to release the mandibular impression, as was described in the case of the maxillary impression. Fig. 38 shows the finished mandibular impression; Fig. 39 shows the finished maxillary impression.

When the impression has been washed and dried, it is coated with the shellac filler.

## CAST MAKING

**A Method of Protecting the Borders of the Impression.**—The borders of the impression which received careful attention during the impression-taking process are now protected in the following manner. A beading of wax wire is placed upon the buccal and labial borders extending from the posterior on each side to the labial frenum. This bead is placed at the point along which the *roll* of the border terminates, or about the same distance from the crest of the border as the wax wire was placed on the inner surface in securing peripheral adaptation. This carding wax bead is sealed its entire length against the impression tray, with the use of a hot spatula. Fig. 40 is a schematic drawing of a cross section showing the finished impression encased in plaster; Figs. 41 and 42 show the bead sealed to maxillary and mandibular impressions; the mandibular is inverted.

The operator after gaining experience in the protection of the borders while encasing impressions may dispense with this beading, which prevents the plaster from encroaching upon the periphery.

**Encasing Impression with Plaster.**—A thick mixture of plaster of Paris (no accelerator is used) is piled in a mass upon the bench and the portion of the impression which is not to be included in the cast

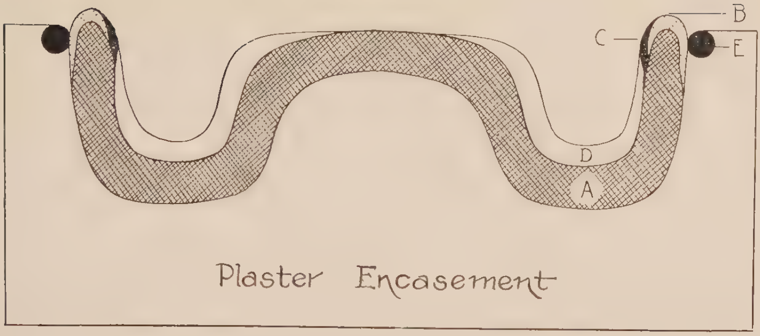



Fig. 40.—Schematic drawing of cross section showing ideal maxillary impression, encased in plaster. Note ideal characteristics: *A*, Black compound individual impression tray; *B*, Kerr's compound, which determines the height of periphery and prevents ingress of air; *C*, flattened carding wax wire, which equalizes the peripheral adaptation; *D*, impression plaster, which secures contact with the tissues over an area against which undue pressure should not be exerted; *E*, carding wax bead, which determines the height of the plaster encasement.

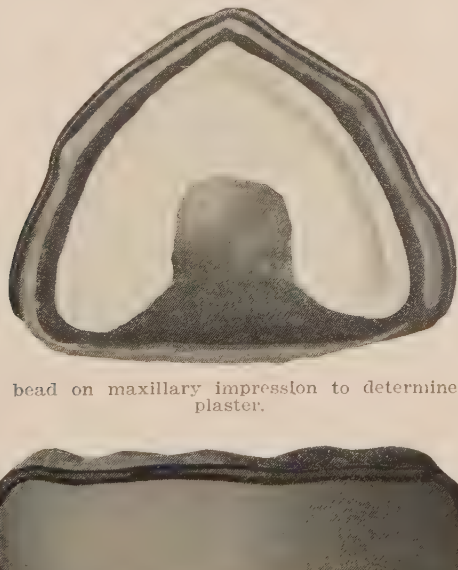


Fig. 41.—Wax wire bead on maxillary impression to determine height of encasing plaster.

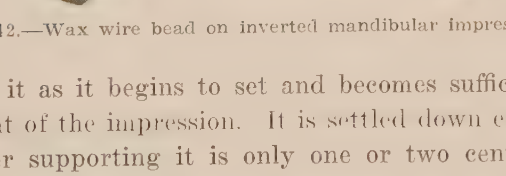


Fig. 42.—Wax wire bead on inverted mandibular impression.

is settled into it as it begins to set and becomes sufficiently hard to bear the weight of the impression. It is settled down evenly until the bulk of plaster supporting it is only one or two centimeters thick. Then with a clean spatula dipped in water the portion of plaster

which is spread out is pulled up against the impression so as to leave the border free above the wax bead (Fig. 43).

The plaster border around the impression is now trimmed neatly and cut so that the walls of the plaster block encasement stand parallel with the median line and form a right angle with the occlusal plane. A saddler's knife (Fig. 44) is a very desirable instrument for trimming casts. The outline of the plaster block follows the general outline of the impression, except that the posterior por-

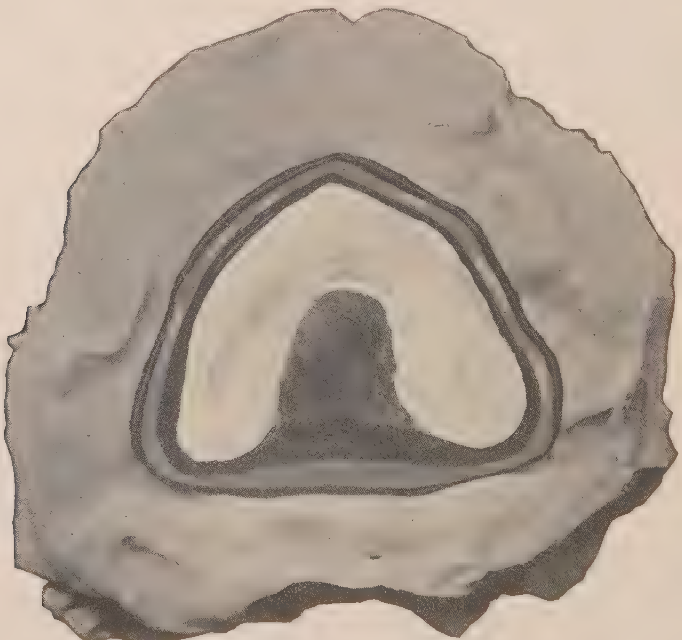


Fig. 43.—The maxillary impression is pressed into the mass of plaster until the wax bead is reached, when a wet spatula is used to bring the plaster up against the wax bead along its entire length.

tion extends laterally and posterior-wise in the region of the tuberosities of the maxillary impression (Fig. 45) and in the region of the heels of the mandibular impression (Fig. 46) some ten millimeters farther than it does elsewhere. This extension is for the purpose of providing a shelf to receive the cast material. Thus, the cast will extend beyond the borders of the impression sufficiently to strengthen the heels and tuberosities, and consequently lessen liability to fracture.

Fig. 44.—A saddler's knife is a very desirable instrument for trimming casts.

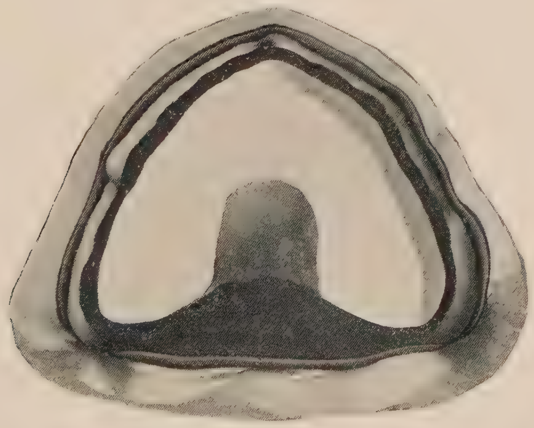


Fig. 45.—The plaster encasement follows the general outline of the impression except that the posterior portion extends laterally and posterior-wise in the region of the tuberosities of the maxillary impression.

**Shellac Is Used as a Filler; Sandarac, as Varnish.** The impression thus encased in cast plaster is again coated with shellac, the shellac covering the top of the plaster casing also. When the shellac is dry, a coat of sandarac varnish is applied.

**Preparing a Matrix.**—When the sandarac is dry, a strip of rubber is wrapped around the encased impression, the strip being allowed to lap along the posterior aspect. A supply of these strips five or six centimeters wide and thirty centimeters in length may be kept on hand for this purpose; an automobile inner tube will supply several; widths will vary according to the depths of the desired casts, and lengths will be determined by the sizes of the different impressions

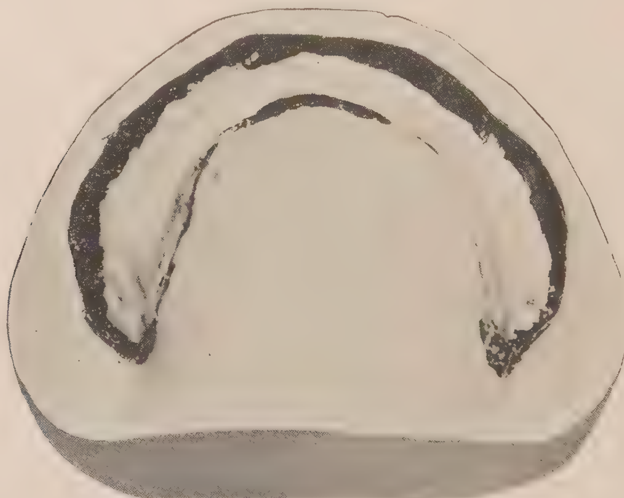


Fig. 46.—The plaster encasing the mandibular impression follows the general outline of the maxillary encasement; in the region of the heels it is extended farther than elsewhere.

with their plaster casings. A rubber band (No. 8 doubled) is put about the base of the rubber strip to hold it firmly in place (Fig. 47).

The use of cast plaster as just described serves, not only to protect the borders of the impression, but serves as well to strengthen the entire impression in such way that it may be jarred as vigorously as necessary to make the cast material, as it is added, settle into position. Jarring the mixture, not only settles it into position, but results in a case-hardened surface on the cast. The instructions accompanying any of the plaster compounds that are available for making casts, stress the importance of incorporating as much of the compound as possible in a given quantity of water in order to secure the most

desirable cast. Plaster of Paris is not used, because it will not withstand compression during the process of vulcanization. If Austin's synthetic stone is used, one ounce of water by measure mixed with three and one-half or four ounces of the compound by measure is sufficient for the average cast required for a vulcanite case. Use a large size plaster bowl and a large spatula. Instead of an ordinary

Fig. 47.—The maxillary impression encased in plaster, trimmed, and provided with rubber matrix.

Fig. 48.—In mixing material for casts, a putty knife with corners rounded is preferred instead of an ordinary spatula.

spatula, a putty knife with the corners rounded is admirably adapted for this purpose (Fig. 48).

**Mixing Austin's Synthetic Stone.**—In mixing Austin's synthetic stone, a measure of water is put into the bowl and two measures of compound are stirred into it; this is to be mixed for a minute, or until the bubbles of air have disappeared from the surface; then a third measure of compound is added and stirred until thoroughly incor-

porated; of the fourth measure a sufficient quantity is added, little by little, and spatulated with the use of considerable pressure, until the mixture apparently has no free moisture in it. The novice will seldom incorporate a sufficient amount of the compound, even when he thinks that he is using too much.

**Method of Filling the Matrix.**—While the synthetic stone is being mixed, the impression, provided with plaster encasement and rubber matrix, is left in a bowl of water to become saturated. When the compound is ready, the case is removed from the water and the free moisture thrown off. A portion of the mass is taken up with the fingers in order to place in the impression. If the compound is so moist as to adhere to the hands, it should be returned to the bowl in order that more may be added; the portion is fashioned into a roll about the size of the thumb and placed in the central or palatal portion of the rubber-banded plaster-encased impression and held in this position until jarred a few times, when the mass gradually spreads out. Additional material is placed on top of the first portion and the jarring continued, and more of the mixture added until it has spread out over the palatal portion down into the ridge portion and up on the buccal inner border, thus excluding the air as it spreads. This is continued until the cast produced will be thirteen to sixteen millimeters at its least depth. This is a suitable thickness for vulcanite cases. If it is thicker than this, much time will be consumed unnecessarily in preparing it for mounting upon the articulator and for investing it in the flask preparatory to packing and vulcanizing. It is now allowed to harden. If the mixture was sufficiently dense, it will have hardened sufficiently at the end of twenty minutes to permit the removal of the rubber matrix. The cast may be trimmed very easily at this time. At the end of an hour, the cast may be separated from the impression, if care is exercised.

**Separation of the Cast from the Impression.**—When the cast material has set sufficiently hard—if allowed to set overnight danger of injury in separating will be reduced—a V-shaped notch is cut through the encasing plaster all along the median line (Fig. 49). This notch is cut through to the black compound and then by means of taps with a light mallet, the plaster may be broken away. The black compound is also broken away either with the mallet, or by prying loose with a knife; the removal of the improvised tray and plaster will be easy, if the case was properly treated with shellac and varnish. However, in using a knife, care should be exercised to avoid cutting the surface of the

cast. In removing the plaster casing, the cast should be held firmly in the palm of the left hand, while the small mallet is used to tap the plaster gently toward the center. Beginners may exercise additional precaution to avoid fracturing the cast, if they will cut another V-shaped fissure directly across the first one. The black compound of the individual tray may be splintered off by prying beneath the heels of the tray. A dull knife is best for this purpose, since any slips will be less likely to mar the cast; the back of the blade is even

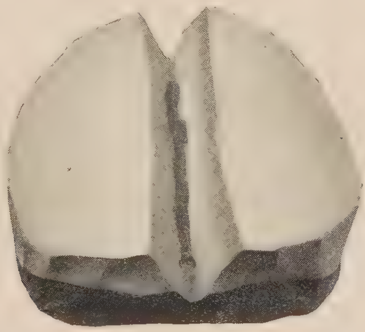


Fig. 49.—In separating the cast from the impression, danger of injury is minimized by cutting a V-shaped notch through to the black compound.

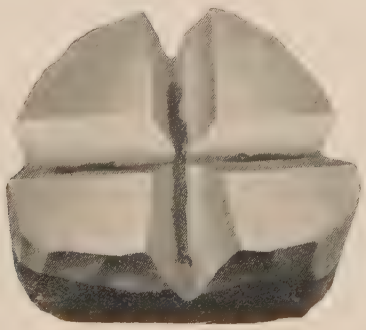


Fig. 50.—In separating the mandibular cast from the impression, since the danger of injury is greater than in the case of the maxillary cast, two V-shaped notches are cut, one along the median line and the other transversely.

more satisfactory. The plaster impression easily may be removed; usually it is carried away with the compound. Portions which remain may be easily removed after the following method: Instead of trying to slip the knife between the cast and the plaster, the dull knife is forced down and in at right angles to the cast, but, before touching the cast, is turned slightly to the right or left, thus using the plaster as a fulcrum for the blade, which will result in chipping away the portions of plaster.

**The Mandibular Cast Should Extend Beyond the Heels.**—The mandibular cast is made after a technic similar to that employed with the maxillary, except that the plaster casing is extended beyond the

Fig. 51.—The finished maxillary cast.

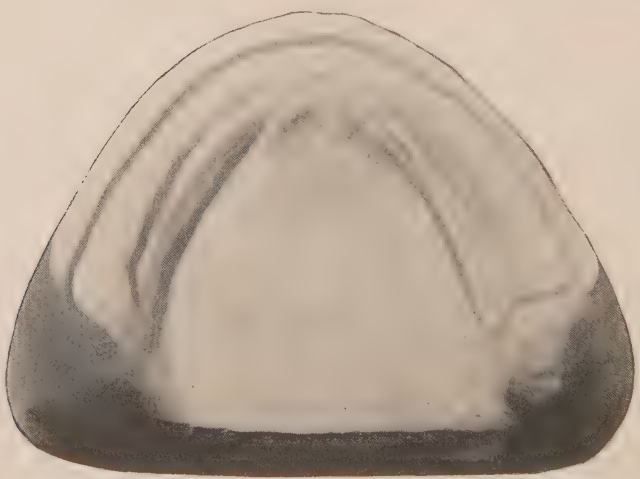


Fig. 52.—The finished mandibular cast.

heels of the impression some five to ten millimeters farther than it was extended beyond the tuberosities of the maxillary. (See Fig. 46.)

**More Care in Separating Mandibular Cast.**—More care is required in removing the plaster casing from the mandibular cast, since it is more easily fractured. The two V-shaped notches should be cut, one along the

median line, the other transversely, or from the region corresponding to that of the first molar across to the region of the first molar of the other side (Fig. 50). The notches should be cut through to the black compound, wherever the compound is to be found, in other places the shellac-stained plaster will indicate that the proper depth has been reached. Figures 51 and 52 show the finished casts.

## CONSTRUCTION OF OCCLUSION MODELS

**Bases of Occlusion Models Are Made of Graft's or Dentsply.**—The casts are now employed in order to construct occlusion models, which will provide a means of obtaining the correct relationship between mandible and maxilla, that is, a means of obtaining central occlusion. A sheet of Graft's base or Dentsply Trubase or similar material is adapted to the cast. The sheet of material is heated over a flame, heating it first upon one side and then upon the other, continuing until the operator must cease if the sheet is not to be entirely distorted. It is then laid upon the palatal portion of the cast and pressed down to close adaptation; the operator continues to press the material to position until it is too cold to change its shape any farther. It is removed from the cast and the buccal and labial portions of one side are passed through the flame until pliable; it is returned to the cast and these portions of the base plate adapted as closely as possible, using the bare fingers, or a cloth if preferable. Each time that a portion is adapted, the base is removed from the cast preparatory to warming another portion. This prevents the cast from becoming warm and also facilitates easy removal of the base when finally completed. Portions of the sheet will extend over the edge of the cast; when warmed with flame and chip-blower, these portions of the sheet are doubled back upon the cast (Fig. 53) so that when warmed again the new edge thus formed may be elongated and pushed out to form the peripheral border. This provides a stronger and smoother and more easily finished border than if an attempt were made to cut to exact outline of the border of the impression and to smooth with sandpaper.

The buccal and labial portions of the other side are treated in the same manner. When this is done, the portion near the labial frenum must be further heated; it will then tend to crease or wrinkle. It is permitted to fold over upon itself and then is warmed with flame and chip-blower and is pressed down upon the cast. Since this fold does

not come into contact with the cast, or with the mouth, it is not only not objectionable, but, on account of its added strength, is very desirable. The posterior portion will usually extend beyond the palatal portion of the cast; it should be doubled back upon itself to

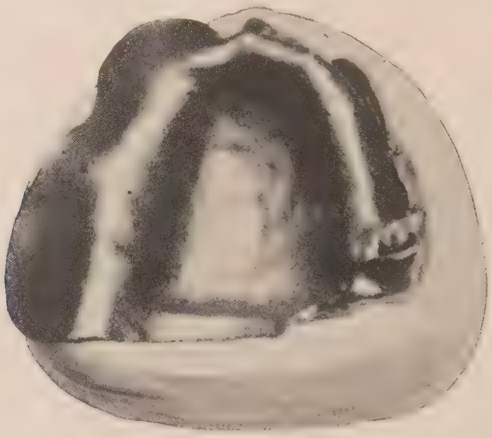


Fig. 53.—The bases of the occlusion rims are made of Graft's base plate or similar material. Portions which extend over the edge of the cast are doubled back.

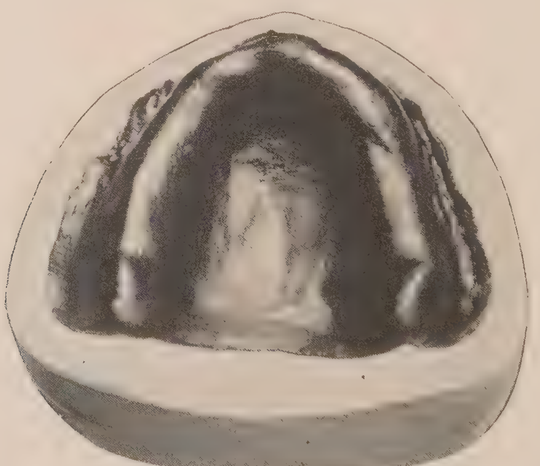


Fig. 54.—Finished base of the occlusion model ready for the wax occlusion rim.

strengthen this margin. Fig. 54 shows the base ready for the wax occlusion rim.

**A Strengthener is Provided for the Base of the Mandibular Occlusion Model.** In adapting a sheet to the mandibular cast, the palatal portion is warmed and cut out with a pair of scissors. Since the

maxillary base sheets may thus easily be adapted for mandibular casts, the author purchases sheets for maxillary casts only. A strengthener, one of the flattened wires used for strengthening mandibular impression trays (see Fig. 11), is heated and placed full length well down upon the lingual side of the ridge. When so placed (Fig. 55) it will not interfere with the subsequent arrangement of the teeth.

**The Wax Is Formed into a Roll as Nearly Homogeneous as Possible.**—In constructing the wax occlusion rims, two sheets of pink base plate wax are heated and folded together and then upon themselves again, and heated again and this operation repeated, until the

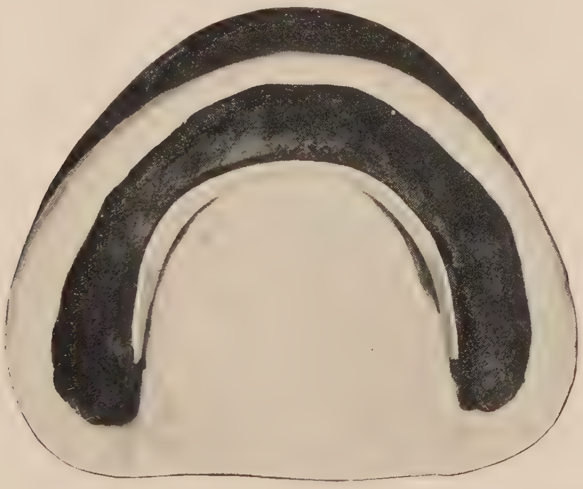


Fig. 55.—A wire strengthener is placed on the base of the mandibular occlusion model well down upon the lingual side of the ridge so that it will not interfere with the subsequent arrangement of the teeth.

two sheets have been formed into one roll of a texture that is without grain and as nearly homogeneous as possible. This roll should be twenty millimeters in diameter. One end of it is heated in the flame and the dripping wax permitted to fall upon the ridge portion of the base plate along its entire length as it rests upon the cast. The roll is bent into a U-shaped form and pressed down firmly upon the ridge along its entire length, with the anterior portion well forward. Since it is supported by the cast, portions of the roll grasped between the thumb and forefinger may be pushed farther down along the buccal and palatal borders in order to provide a better foundation than if the roll were allowed merely to lie on the crest of the ridge and an

attempt made to fill in with wax between the roll of wax and the base plate. Fig. 56 shows the roll between thumb and forefinger, in the process of adapting to the base of an occlusion rim.

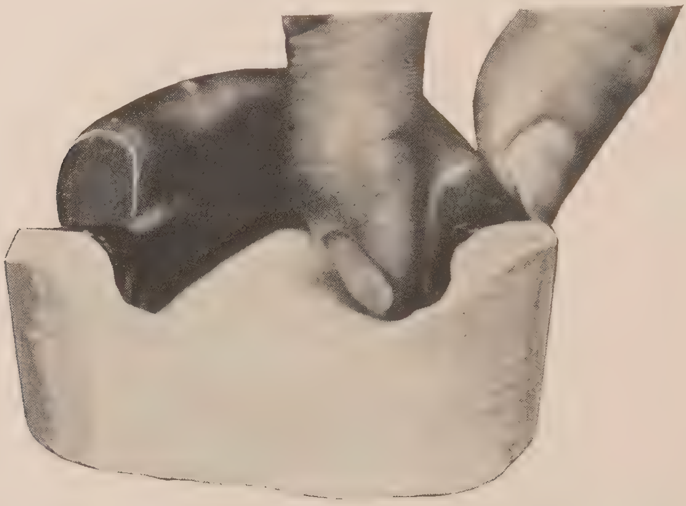


Fig. 56.—Grasping the roll of wax while warm between forefinger and thumb, it is easily pushed down upon the crest of the ridge until it has a substantial foundation along the buccal and lingual borders.

Fig. 57.—Aluminum square with corners turned down for legs.

**Wax Rims Are More Easily Made if Made Quickly.**—The formation of the wax occlusion rims, from the moment of heating the two sheets of pink wax to placing them in final position on the base may

be accomplished best if completed within a brief period of time. If the operation does not consume more than approximately two minutes, the wax will remain in condition for easy manipulation all the while. If allowed to cool so that it becomes necessary to use the spatula to melt the wax down to position upon the ridge of the base, many minutes may be required. When in position as described, the base is inverted and placed upon a heated aluminum square designed for this purpose (Fig. 57) and moved upon it until the surface is leveled (Fig. 58). The height of the occlusion rims will be determined by the operator's knowledge of the case. The rims should always be constructed higher than the case requires, so that any

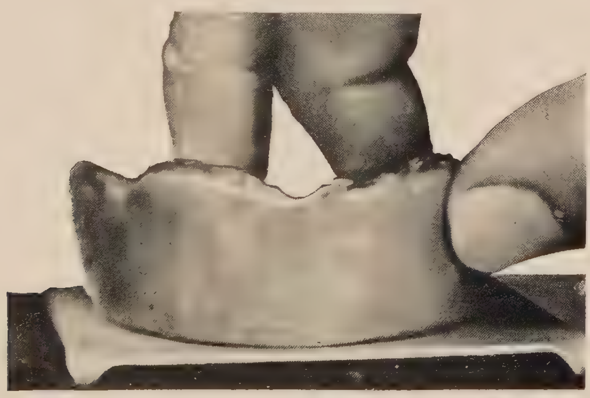


Fig. 58.—The occlusion wax rim is leveled by moving upon the heated square of aluminum.

changes may be made by cutting away a portion of wax, instead of being compelled at the chair to add a portion.

The base with occlusion wax rim is now removed from the cast and a hot spatula employed to smooth a portion of the excess wax into uneven places. A warm knife is employed to cut away labial, buccal, and palatal bulk; the width of the occlusal surface is reduced to the width of a universal occlusion rim gauge. This universal occlusion rim gauge in shape approximates the ridges of all mouths. (Fig. 59 shows the exact size; operators will desire to use this as a pattern in order to construct one of metal or fiber board.) When both maxillary and mandibular occlusion rims have this same shape, they will more nearly occlude than if each had been shaped arbitrarily. Fig. 60 was made from a photograph of occlusion rims upon their respective bases, ready for insertion.

**Central Occlusion Defined.** The wax occlusion rims are given a smooth polished surface by projecting a flame against them with the chip-blower. The rims are now ready so that when the patient ar-

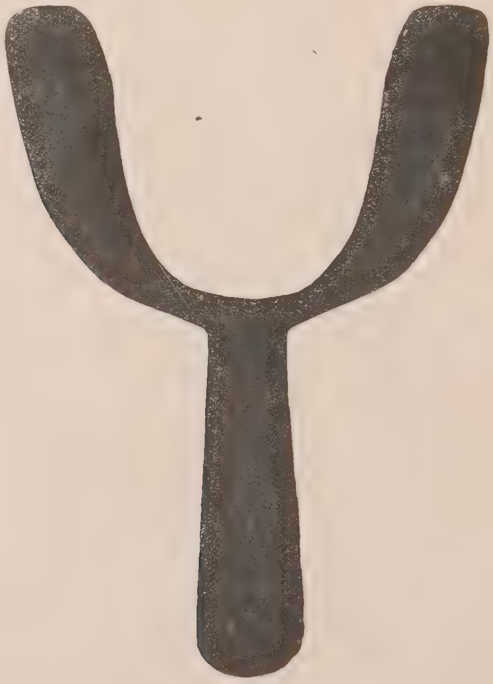


Fig. 59.—Universal occlusion wax rim gauge (exact size), which is used to give the same shape to both maxillary and mandibular wax occlusion rims.

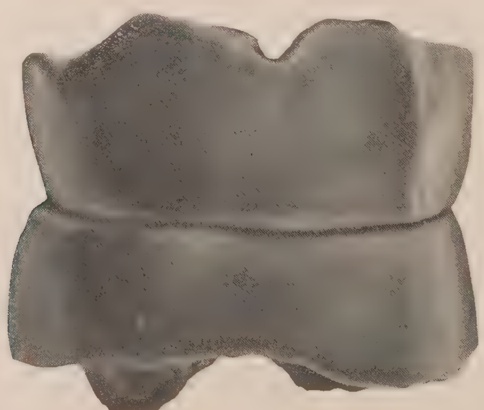


Fig. 60.—Occlusion rims ready to be placed in the mouth. Of these the maxillary is the first to be inserted.

rives, the operator may proceed to use them in securing a record of the desired relationship of mandible to maxilla—the relationship which is called "central occlusion." Central occlusion is that habitual position of the mandible, from which all movements of the mandible begin. When the mandible is in this position, the heads of the condyles are, except in rare instances, in their most retruded positions in the glenoid fossae.

**Inserting the Wax Occlusion Rims.**—With the patient seated, the operator cleanses his hands and washes the occlusal rims in cold water. Excess moisture is wiped or thrown off and powdered gum tragacanth, or some of one of the proprietary preparations which are used to retain dentures, is sprinkled lightly over the inner surface of the maxillary rim. This is gently placed in the patient's mouth and, with the middle finger resting at first just back of the anterior portion of the rim and in the median line of the palatal portion, the base is massaged back and upward to position. The lips and cheeks are then brought down in an attempt to bring them slightly below their normal rest position. If brought slightly below, the lips and cheeks will more nearly assume normal position than if the patient is trusted to bring them, by a facial grimace, down over the wax. Any discouraging remark of the patient as to bulk of the rim is anticipated by the operator's explanation, that this "trial base" is much larger than the finished denture will be and that its unnaturalness and discomfort need be borne for a few minutes only. However, if there is a marked protrusion, or retrusion, of the lips, this should be corrected at once by removing the rim from the mouth and adding or removing wax as is indicated.

**Locating and Marking the Median Line.**—The median line is now marked upon the maxillary occlusal rim. The lip is raised and a sharp instrument used to mark a line from the labial frenum to the lower border of the wax rim. This will in most cases coincide with the median line of the patient's face. Whether in a given case this line actually coincides with the median line of the patient's face, may be determined by the operator, in the following way: if the operator will stand squarely in front of the patient and a few feet distant, he may "sight" to see whether the line on the wax is directly in the median line of the face, and may then correct it if it is not. If there is any uncertainty in the operator's mind as to whether the line marked on the wax is the median line, he should move the patient's lip first to one side and then to the other in order to make sure that

the dry lip is not held by the wax out of normal position and does not on this account present an appearance that is misleading.

**Low Lip Line Is Not Absolute.**—After correctly marking the median line, the "low lip line" is next established and marked with the sharp instrument. This line is the lowest possible *rest* position of the upper lip. This line, in the case of a person having his natural teeth, coincides with the incisal edges of the central incisors. Artificial central incisors may be placed with the incisal edges above or below this low lip line, according to the esthetic requirements of the case. This is to say, that the low lip line serves as a guide and is not to be regarded as an absolute line determining the arrangement of the teeth. After marking this line upon the anterior portion of the wax rim, it is removed and the mark extended horizontally on both sides to the extreme distobuccal portions of the wax.

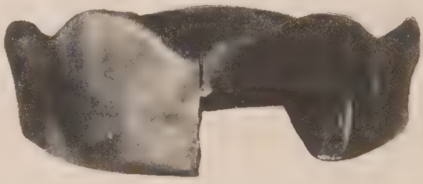


Fig. 61.—This figure shows sufficient wax cut out to provide space for three anterior teeth.

The next step is to cut away all of the wax below this line and also sufficient additional wax is cut out to provide a space on one side of the median line to receive three anterior teeth. Fig. 61 shows this space. No provision is made for marking a *high* lip line or for the width of the six anteriors, since this provision is not necessary with the writer's method of setting up the six anterior teeth.

If the operator has no records to which he may refer—records of this particular patient's teeth as to size, form, hue (shade), irregularities such as spacing, lapping, stains or imperfections—he will be influenced in his selection of teeth by the patient's face form, complexion, color of hair, and color of eyes.

**In Selecting a Mould the "Trial" Method Is Surest.**—In selecting a mould of tooth suited to a given patient the surest method of securing satisfactory esthetic effect is the trial method. It is possible to devote enough study to the subject of tooth selection to enable the dentist to select a mould intelligently and upon a scientific basis. However, few dentists are willing to devote the time necessary to become skillful in selecting teeth with a degree of correctness which

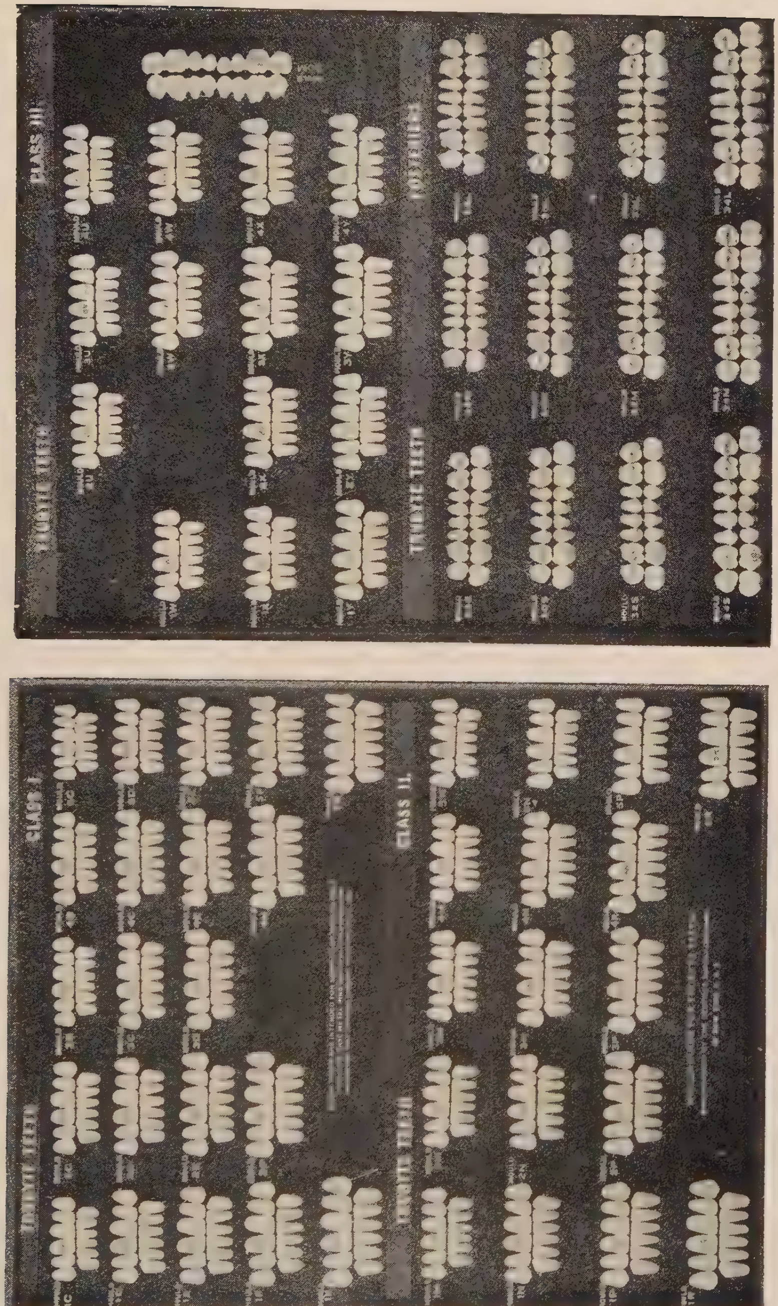


Fig. 62.—Trubyte mould guide as supplied by the Dentists' Supply Co.

may be classed with the intuitive. The author suggests an alternative. Every dentist has some degree of appreciation of the symmetrical; harmony and color values have some place in his judgments. The place which these have and the degree to which the dentist may be able to exercise them may be compared to a knowledge of harmony in music. A knowledge of harmony in music may include the fact that there are instances in which a slight discord may accentuate the harmony; further, a person might not know how to arrange the score for various instruments, but he might know full well whether the music played by the orchestra was melodious. If such a person were required to produce a melody he might succeed after repeated trials with different parts in getting the notes played by the different instruments to blend agreeably to his own ear and that of his audience. The dentist may in a similar way secure the desired effect by availing himself of the entire stock of teeth, and by repeated trial, secure a perfectly agreeable esthetic result. The Trubyte Mould Guide as supplied by The Dentists' Supply Company of New York City makes the entire stock of teeth immediately available for the dentist's selection (Fig. 62). Except in the rarest cases the 52 moulds of anterior teeth and 13 moulds of posterior teeth may be reduced to 24 moulds of anterior teeth and 3 of posterior teeth. This mould guide includes in posterior teeth long moulds only (34 L, 133 L, 137 L) (Fig. 63).

**Wax Is Cut Out from One Side of Median Line.**—Preparatory to setting the anterior teeth upon the maxillary base, the wax is cut out, as suggested above, namely, the wax from the median line to the region of the first bicuspid on one side is cut out bodily and high enough to receive three anterior teeth. If the left side is cut out first, the wax on the right side is retained to assist in keeping the lip out in normal position and also to serve as a partial guide in placing these first three teeth.

**Removing Black Wax from Teeth Is Very Important.**—A central incisor tooth is now removed from the carding wax and a tiny flame projected against the pins in order to melt the black wax. When the wax is melted, the operator, without using the flame, gives the bulb of the chip-blower a final squeeze in order to blow the black wax so far from the pins that it does not interfere with the subsequent trial of the tooth in the mouth. With a spatula the pins of the central incisor are covered with hot base plate wax, and as the wax chills sufficiently to permit the operator to move the tooth with-

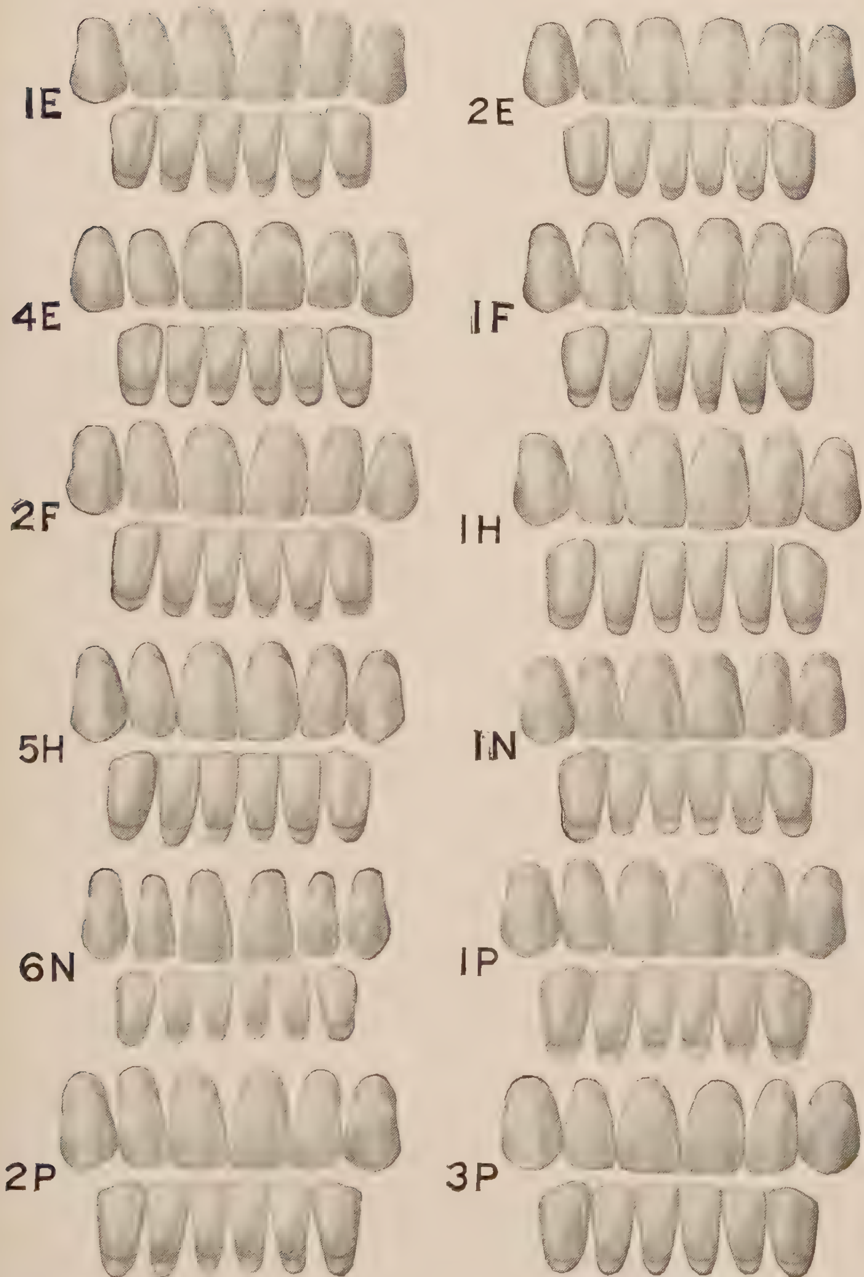



Fig. 63.—The author finds that, except in rare instances, his needs are met with a mould guide containing less than one half the number of moulds included in the Trubyte Mould Guide.

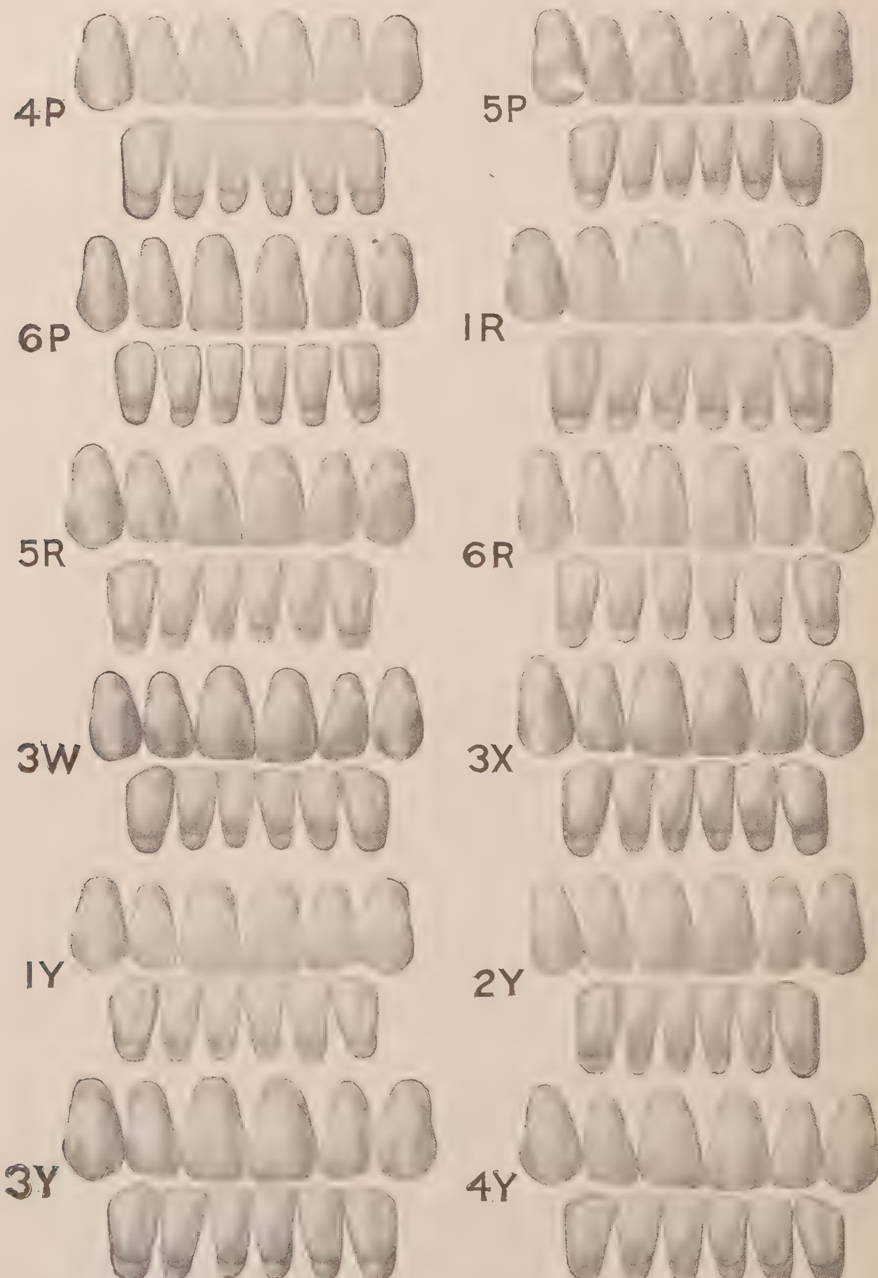



Fig. 63 (Continued).

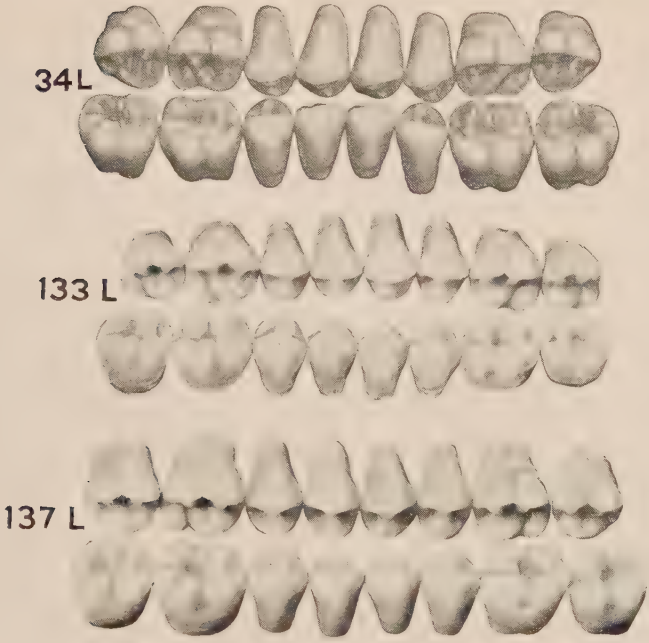



Fig. 63 (Continued).

out allowing the wax to run off, it is placed in position. Its mesio-incisal angle is placed against the hard wax which still remains in the labial region and the tooth is sealed into position with additional hot wax.

Each one of the remaining twenty-seven teeth is treated in a similar manner, so far as removal of the black carding wax is concerned and in each instance the hot pink wax is employed to attach the teeth to the occlusion rim. Of course, in the case of the diatoric bicuspids and molars any black wax is removed from the holes of these teeth and the holes filled with the hot pink wax and then attached. This seemingly inconsequential bit of technic is practically of considerable importance. Failure to remove the black wax results in imperfect attachment to the rim and permits easy dislodgment from position at any moment during the trying-in process. Failure to surround the pins or to fill the holes with hot wax permits the saliva to creep in between tooth and wax and destroys any possibility of close attachment. Not only is this true of the lack of firmness on the rim but it applies to the increased trouble that will be met in changing the position of a tooth. Ease of manipulation in lapping, spacing or otherwise changing the position of the teeth is

greatly enhanced, if the teeth are treated as described; the tooth to be moved needs only to have the flame directed by the chip-blower against it, the surrounding wax becomes softened sufficiently to permit movement and then after the tooth is moved, the wax, growing cold, fixes it in its new position.

After the central is thus set up, the lateral and cuspid on the same side are likewise placed in position. This arrangement of the three teeth is tried in the patient's mouth. The operator may then judge the effect and make whatever changes in these he may regard as necessary to make the result as harmonious as possible. Fig. 64 shows a central, a lateral, and a cuspid ready to be tried in the mouth.

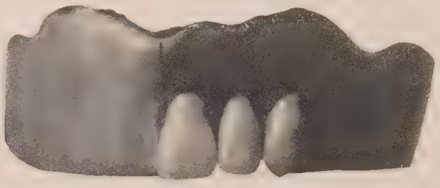


Fig. 64.—Three anterior teeth selected and arranged in keeping with the author's idea of the esthetics demanded by this particular case. If agreeable to the patient, this arrangement may be final.

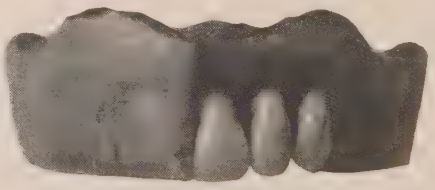


Fig. 65.—The three teeth which were arranged properly in Fig. 64 according to the author's idea of esthetics, are here arranged improperly by way of comparison. Note especially the disto-buccal angle of the cuspid is too prominent; the gingival third of the lateral is too prominent; the incisal edge of the central is not prominent enough.

**Questions Which the Operator May Ask Himself in Getting Esthetic Effect.** The operator will ask himself regarding the central, "Is it wide enough? Is it long enough so that, when the patient smiles, no vulcanite will show? Does the incisal edge extend anteriorly far enough to assist in holding the lip out? With the patient's lip in position as near normal as possible, does the incisal edge show sufficiently?" It should show slightly more than at this time commends itself to either operator or patient as in keeping with the most harmonious result, since, after the denture is worn a few weeks, the lip will lengthen perceptibly. After this lengthening of the lip, the resulting harmony will be increasingly pleasing. As one may note,

too many patients never show artificial teeth, unless during a broad smile. If there is the slightest doubt in the operator's mind as to whether he has placed the tooth to best advantage and with most pleasing effect, he should warm it and change its position until the imagined increased harmony shows itself to be undesirable, or desirable. The tooth may easily be returned to its previous position or the interval modified to the operator's entire satisfaction.

With reference to the lateral, the operator will ask himself: "Is

Fig. 66.—Typical normal occlusion of natural teeth, external view. (From photograph of specimen in possession of Dr. Frederic A. Peeso.)

it too long? or too short? (In the vast majority of cases, if it is pushed up until it is shorter than the central, the result will be more effective.) Will it look better if lapped or spaced or rotated with distoincisal angle outward? inward? Is it too broad?" If the patient is a lady, try a very narrow one from some other mould. Dr. J. Leon Williams has pointed out that in nature a narrow lateral in the maxilla is characteristic of the human female rather than of the male. "Is the neck of the lateral closer to the base than the neck of the central is?" It should be. Fig. 65 shows these three teeth set up

with poor esthetic result. Figs. 66 and 67 are skull specimens worthy of study.

"Is the cuspid long enough for the other teeth of the mould I have selected?" No. Except in rare instances the teeth are not so carded.

Fig. 68 shows the six anterior teeth selected from four different moulds. "Is the cuspid prominent enough at its neck?" If not, the

Fig. 67.—Internal view of natural teeth shown in Fig. 66. (From photograph of specimen in possession of Dr. Frederic A. Peeso.)

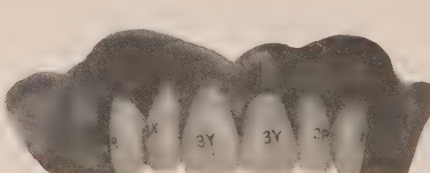



Fig. 68.—A more pleasing esthetic effect is often produced through selecting the six anteriors from more than one mould. This illustration shows centrals 3Y, hue 14; right lateral 3X, hue 15; left lateral 2P, hue 15; cuspids 1R, hue 16. In sending a case to the commercial laboratory the dentist should select the teeth and mark in the wax above them the hue desired for each.

cuspid eminence will not be restored. It should be possible to palpate its prominence, more or less easily and clearly, with the fingers upon the lip. "Is its distobuccal angle prominent?" It should not be. If the cuspid presents too prominently this distobuccal angle,

the whole set-up will appear to be entirely too wide for the patient's mouth. Especially is this true, when the cuspid is of the same hue as the central and lateral. Warm it, and with thumb and forefinger slightly rotate it (left cuspid) from left to right until, as the operator views the case in the mouth from a position directly in front (as he focuses both eyes upon the median line), the angle presented is not obtrusive. "Does the cusp of the cuspid denote age or youth?" If too pointed, it may be too youthful in appearance for this case. In most instances, it should be ground off, taking care, however, to maintain the semblance of a cusp.

**"Trial" Method in Selecting Shade or Hue Is Best.**—Just as in the selection of the most suitable mould, the most satisfactory method of selecting the most harmonious hue, and generally the one productive of best results, is the empirical method—that of determining the most desirable through a process of trial. Until a sufficient number of dentists have become interested in teeth which will present a more lifelike appearance, the manufacturers will not be justified from a commercial standpoint in producing them. The possibility of such creations is indicated in the results achieved by the porcelain jacket crown ceramist. The hue guides usually supplied by the manufacturers of artificial teeth have wide variations of five hues, viz., gray, orange, blue, pink, and green. Each of these runs the gamut from light to dark, about five variations of each. For example, from The Dentists' Supply Company's guide the author discards, except in the rarest instances, Nos. 1 to 8 inclusive, 10 to 13 inclusive, 17 to 19 inclusive, and Nos. 23, 24 and 25. Of course this system of discarding applies to full denture cases. In partial restorations, the operator will wish to avail himself of a full selection from the guide and then will wish that he had many more hues from which to select, owing to the fact that any discrepancies in hue will be disclosed in glaring fashion as the artificial teeth are placed in close contiguity to the natural teeth. This will be true in the case of the closest possible approximation to the hues of some natural teeth.

Since in natural teeth the hue of any individual tooth is determined by the pigment of the dentine, and since the larger the tooth the larger the bulk of dentine, it follows that the amount of pigment will be larger in the larger tooth. For example, in any set of teeth that may be selected for observation or study purposes, it will be found that the central contains a larger amount of dentine and consequently a larger amount of pigment and that it will therefore be more opaque

than a lateral—hence it will be of darker hue. The cuspid is large in its labiolingual aspect and is darker still than the central and very noticeably darker than the lateral.

**Combining Teeth of Several Different Hues Is Often Desirable.**—In view of these facts, the operator in his arrangement of artificial teeth will wish to "stagger" his hues, that is, make his selections so that the effect produced will approach this appearance of the natural teeth in which are harmonized the lateral, darker central and still darker cuspid. When the author desires to use hues from more than one set of Trubyte teeth he finds that the following combinations produce very acceptable effects: centrals, shade No. 14, with laterals, shade No. 15, with cuspids, shade No. 16, with bicuspids and molars, shade No. 16; or centrals, shade No. 15, laterals, shade No. 9, cuspids, shade No. 16, bicuspids and molars, shade No. 16; or centrals, shade No. 16, laterals, shade No. 9, cuspids, shade No. 20, bicuspids and molars, shade No. 20; or centrals, shade No. 22, laterals, shade No. 14, cuspids, shade No. 22 and bicuspids and molars, shade No. 22.

**These Combinations Are Not Given as Ideal but as Most Harmonious.**—These combinations are not submitted as ideal selections, but as those selections which have very often proved themselves by trial as suited to give the most satisfactory results in cases requiring combinations in order to get the most harmonious effect. In fact, while such combinations have been found to be the most harmonious for the cases in which they are used, and have proved very satisfactory in appearance within ordinary conversational range, a closer inspection discloses that there is yet much to be desired before the ideal is attained.

**Helping the Patient to View the Teeth with a Habitual Expression**—After the three anterior teeth on one side have been set up and arranged satisfactorily, the maxillary occlusion model is removed from the patient's mouth and the wax on the other side of the median line is cut out and the three anterior teeth on this side are set up in like manner to that employed with the first three. If the patient has previously worn artificial dentures the author usually sets up the six anterior teeth without consulting the patient and then when they are in position in the mouth, the bib towel is removed, and the patient requested to stand before a large wall mirror. Then the patient is engaged in conversation and the length and general effect of the teeth in relation to the form of the face and complexion, and especially the relation of the teeth to the lips, are noted. In the case of women patients

viewing their "new teeth" it is not unusual for them to wear expressions of the type known to milliners when new hats are being tried on, that is to say, the expression at such a time is almost anything but normal or natural. It is difficult enough to select teeth entirely harmonious with a face wearing a normal or natural expression, but when this expression is changed until it is unnatural and unharmonious to the patient herself, even without teeth to which she has had no time to become accustomed, the introduction of artificial teeth into a scheme of harmony (or lack of harmony) of this kind is not very liable to obtain desirable results. Fig. 69 shows patient grimacing in trying new teeth.

Usually, after the maxillary occlusion rim carrying the six anteriors is inserted, the bib towel removed, and the patient directed to

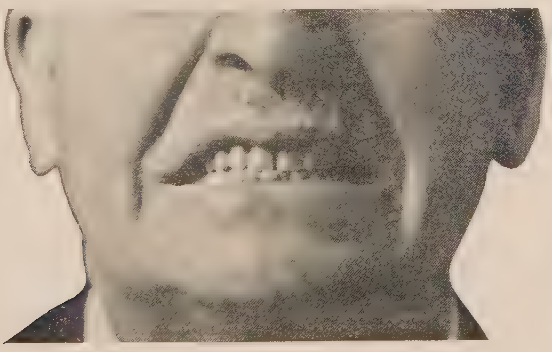


Fig. 69.—Patient grimacing instead of smiling.

view the effect in the mirror, the author turns to a lavatory in another part of the operating room and washes his hands, or otherwise busies himself. All the while, although apparently taking no particular notice of the patient's actions, he continues the conversation so that the patient may have opportunity to see himself in action, especially in conversation. The response to a request for a smile is usually a contraction intended to show the teeth but which bears little resemblance to a smile. At this time, the operator has usually approached the place where the patient is standing before the mirror, and also looking into the mirror, may exaggerate this grimace of the patient in a facial contortion of his own and then follow it with a smile, thus enabling the patient to see the difference. This soon enables the patient to approximate his own normal smile, until the new effect

becomes more an effect due to the new artificial teeth and is not an effect complicated by these other elements of unnaturalness.

It will be found helpful also to provide the patient with a magazine carrying a full page advertisement in large print and without any big words to embarrass the reader. If the operator requests the patient to read it aloud, he may note the relationship of lips and teeth and be in better position to adjust them to meet the requirements.

Any changes which the operator deems necessary are now made and suggestions of the patient or his friends, which commend themselves as suggestions worthy of trial, are also incorporated.

**Relatives or Friends Should Be Present to Assist in the Selection and Arrangement of Teeth.**—If the patient has never worn dentures, it is wise to show the patient the very first tooth put upon the occlusal rim and each tooth selected should be shown as it is inserted. The effect of gradual additions to the number of teeth is usually more pleasing than a full quota on first appearance. If there are any relatives or friends whose likes or dislikes are likely to be important in influencing the patient's final decision in the selection of teeth or whose observations later may be a decidedly helpful or deterrent factor while the dentures are being worn, they should be urged to accompany the patient and "assist" in the selection. Any suggestions of such friends or relatives incorporated in the finished dentures will serve to make such persons, in a measure, responsible for the final effect, and allies of the dentist, whenever other people of different opinions and esthetic appreciation raise questions as to the good judgment shown in the selection and arrangement of the teeth.

**Preparing the Wax Models After the Anterior Teeth Have Been Arranged.**—The occlusion model, with the six anterior teeth in such position as the operator and patient agree is most harmonious, is removed from the mouth and the remaining wax is trimmed to a V-shaped form. In the region of the first molar on both sides a notch is cut in the wax, and the wax then smoothed with chip-blower and flame so that there are no ragged edges (Fig. 70).

**An Anterior Tooth of the Mandibular Model Is Provided as a "Stop."**—The mandibular occlusion model is now tried in position without the maxillary model. The base of the model is previously supplied with some powdered gum tragacanth. The height of the lip line is noted and marked. The operator should keep in mind that this lip line is too often placed too low. After marking this line, the model is removed

and the wax cut down to this line, and then smoothed by placing the model upon the heated aluminum square. All of the wax in the portion to be occupied by the six anterior teeth is cut out and down to the base. A central incisor is sealed firmly upon the base in the median line or near it. The incisal edge of this tooth will be on a level with the lip line previously marked. Since the marking was cut away at this point, when the wax was cut out, the height may be found by placing the aluminum blank (cold) upon the wax remaining at the heels of the model and bringing this blank or square forward sufficiently to permit the tooth to be brought up against it. This tooth is used as a ''stop'' when the patient closes in central occlusion and in order to determine the proper interval between the upper and lower casts when these are mounted upon the articulator. (See Fig. 70. Also see p. 232 for use of this tooth as a stop.)

**Pooling the Wax of the Mandibular Model.**—If the base plate extends too high in the region occupied by the ascending ramus, it will interfere with freedom in closing; on this account, both the base and the wax rim are cut away freely. A spatula with straight blade is now heated very hot and pushed into the wax on one side of the model. The wax heated by this first operation is thrown out; the other side is treated in a similar manner. The removal of a portion in this manner is for the purpose of preventing an overflow of the wax when all of it, except the extreme borders of these posterior bodies of wax, is melted until it becomes liquid. In order to have these bodies of wax in similar condition when the operation is completed, the operator will employ the hot spatula on right and left alternately.

**The Securing of the Desired Closing Movement into Central Occlusion.**—The occlusion models are now in proper condition to be used in securing central occlusion. The maxillary model with its six anterior teeth is removed from the water in which it has been cooling, the water is thrown off, a small amount of gum tragacanth is sprinkled upon it, and it is then placed in position in the patient's mouth. The bib is removed and the patient is requested to stand where the light will be as advantageous as possible. The melted wax of the mandibular model has sufficiently congealed so that it may be carried to the patient's mouth and also placed in position. As the mandibular model is carried to the mouth it is held high enough that the operator may see that no wax has flowed over the sides and into any portion of the base which is to be occupied by the mandibular ridge.

The operator employs the thumb and finger to hold the mandibular model firmly in position. In order not to interfere with the patient's closing movement, the operator uses thumbs and forefingers in the following manner: He presses his finger nails into the wax on each side and uses his thumbs beneath the mandible as parts of a clamp. When the mandibular model is thus held in position, the operator closes his own jaw with a snap, as an indication to the patient that he is to do the same. He closes until the central incisor of the

Fig. 70.—Maxillary occlusion wax rim has notches cut in the wax to assure correct replacing upon the mandibular rim after central occlusion is secured. A central incisor is sealed firmly upon the base in or near the median line to serve as a "stop" when the patient closes in central occlusion.

mandibular case is in contact with the palatal portion of one or both of the central incisors of the maxillary base. This relation of the maxillary and mandible will be correct.

The success of this method of securing central occlusion requires among other things that the wax shall have been thoroughly melted and that the depths of the pools extended down to the base. Otherwise it is doubtful whether the patient will have been able to

close far enough to bring the incisor in front, which acts as a stop, against the palatal surface of the centrals of the maxillary model.

It may be recalled that throughout the technic employed, at no time have the two occlusion models been tried in the mouth at the same time, until the moment when the mandibular was inserted in readiness for the patient to close to central occlusion. Special attention is called to the fact that the occlusion models are in the mouth together only when the operator is ready to use them together. There will be no helpful purpose served in trying them in the mouth before they are ready for the closing movement. In closing, the V-shaped wax notched ridge of the posterior portion of the maxillary model is forced partially through the nonresisting soft wax of the mandibular rim. This makes such an imprint in the mandibular wax rim that subsequently the maxillary may be removed from and correctly returned to its place on the mandibular without the employment of any other guide than the imprint itself.

**Summary of Precautions.**—It was stated above: "This relation of maxilla and mandible will be correct." The correctness is assured through the preparations made for the final closing movement. An effort is made to do everything possible to make the physical conditions contribute to a natural, normal closing movement, and as strenuous an effort is made to avoid every phase in construction that might possibly interfere with such habitual closing movement. To summarize some of the precautions: (1) The bases are adapted to the casts as perfectly as possible, so that when put into the mouth they will seat securely and give the patient a feeling of security in closing (the adaptation is such that the patient is not afraid the gums will hurt if he closes tightly against them nor that the bases will move when he tries to close). (2) The wax of the models is smoothed so that the lips easily assume their normal position. (3) Care is taken in smoothing or shortening the occlusion models to make sure that they will not interfere with each other or with the tissues of the mouth. (4) The anterior teeth provided on the maxillary model make the patient feel that the closing movement is more real. (5) Nothing is said to the patient about "taking the bite" or "biting," and nothing else is said or done that may direct the patient's mind to the closing movement in such a way that he will be unduly or unusually conscious of a movement which is ordinarily so habitual that he never gives it a thought. (See Chapter II, Some Psychological Phases of Full Denture Prosthesis.)

**Operator May Reassure Himself as to the Correctness of the Occlusion.**—The occlusion models are allowed to remain in the mouth until the wax is thoroughly congealed. The patient is requested to open and the operator may then remove the models either together or separately. They are next thoroughly chilled. If the operator wishes to assure himself absolutely as to the correctness of the occlusion as he has registered it in the closing movement, he may warm a sharp knife and trim away sufficient wax from the mandibular occlusion rim

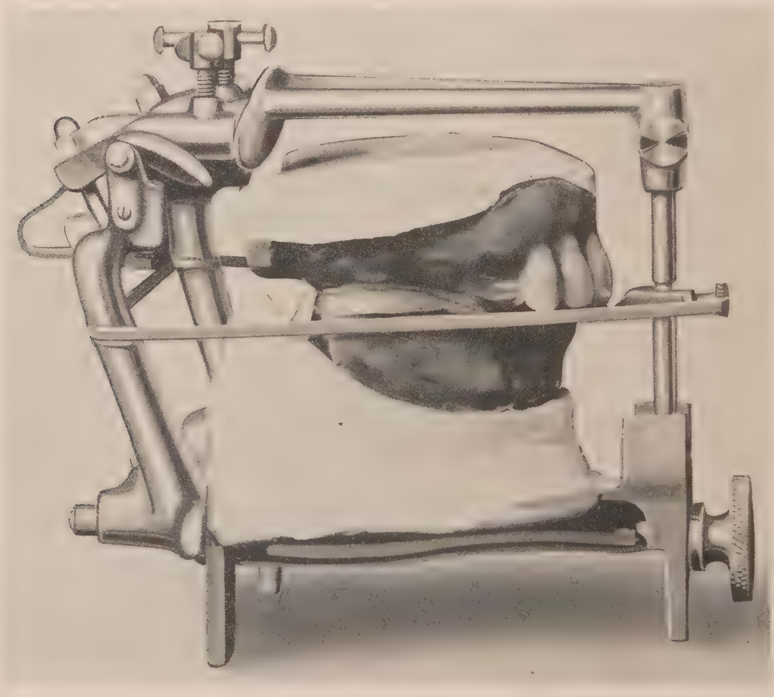


Fig. 71.—In luting to the articulator, the mandibular cast is settled into a mass of plaster on the mandibular bow until the occlusal plane of the occlusion rims is in the same plane with the occlusal plane of the articulator. The occlusal plane of the articulator is indicated by the rubber band.

so that when tried in the mouth again, the sides of the former wax pools will not determine the closing movement by guiding the maxillary V-shaped wax rim between the sides of the wax pools into the position already registered. He may cut away all of the wax from the sides of the mandibular rim, except just enough of the imprints on the occlusal surface to enable the operator to see whether, during this second closing movement, the maxillary section does or does not fit into these imprints.

**The Occlusal Plane of the Wax Occlusion Models Should Be Parallel with the Occlusal Plane of the Articulator.**—The occlusion models are now removed and placed upon their respective casts and properly seated; then each is sealed to its cast with a thin film of hot wax along the border. If the dentist insists upon sending his cases to the commercial laboratory, he should indicate above each of the six anteriors the hue desired. Fig. 68 shows the teeth with hue and mould thus indicated. The maxillary and mandibular models are now occluded

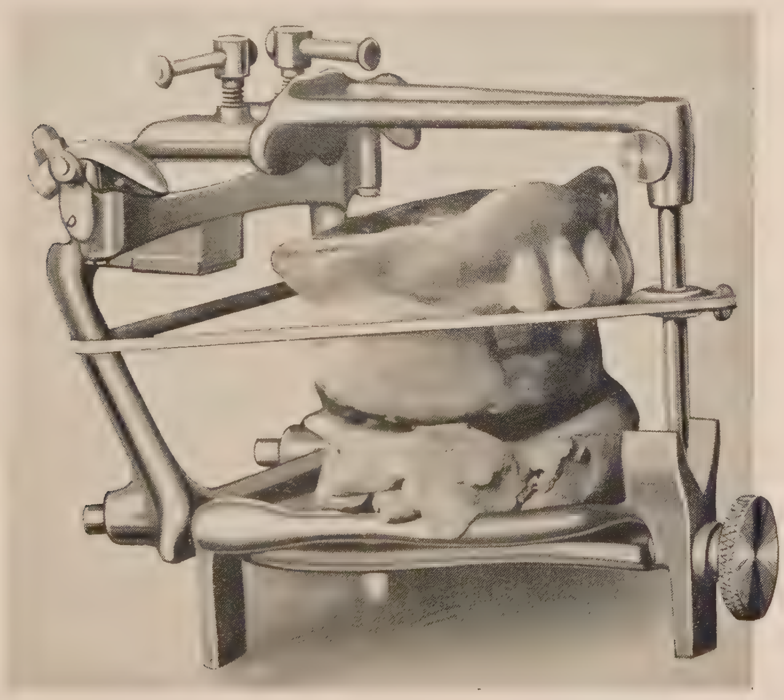


Fig. 72.—Often the casts are too large to mount conveniently. Plasticine or molding clay is used on the mandibular bow to support the mandibular occlusion model at a height which establishes the occlusal plane. The maxillary model is then luted with plaster, after which the articulator is inverted, the plasticine is removed, and the mandibular model then luted with plaster.

and sealed together with the use of a hot spatula, and then the mandibular cast is luted to the articulator. In luting to the articulator, a thick slow-setting mixture of plaster is piled upon the lower bow of the Gysi Simplex articulator, and when the mixture has set sufficiently to bear the weight of the two casts with their occlusion rims, the casts are settled down and forward until the two central incisors rest on the point of the incisal guide, which is attached to the

incisal guide pin of the Gysi articulator. The occlusal plane will be in the same plane with the notches that are exactly midway between the upper and lower extremities of the upright portion of the frame of the articulator. Care should be exercised to lute to the articulator so that the median line of the casts will be identical with the median line of the articulator—or parallel with a line running through the incisal guide pin and through a point midway between the posts of the posterior upright frame (Fig. 71).

Plaster is now piled upon the base of the maxillary cast and the upper bow with the incisal guide pin is brought down into the plaster, the incisal guide pin coming to rest upon the incisal guide.

**When the Casts Are Too Large, the Case Is Mounted Without Them.**—When the casts are too large to mount conveniently, the case is mounted without the casts. In such instances, Plasticine or molding clay is used on the lower bow in order to raise the models until their occlusal plane is parallel with the occlusal plane of the articulator (Fig. 72). The maxillary model is then luted with plaster to the upper bow and, after this has set, the articulator is inverted, the Plasticine removed, and the mandibular model luted to place. Before mounting, the intaglio of the occlusion models should be soaped or coated with silex in order to assure ready removal. After the teeth are set up and the occlusion has been checked in the mouth, the occlusion models are returned to their Austin casts for the vulcanizing process.

## COMPLETING THE SET-UP IN THE LABORATORY

When the plaster is hard, the wax occlusion models are pried apart and in many instances (depending upon the space to be occupied by the teeth) all of the wax distal to the cuspid on both sides of the maxillary model is removed, and the mandibular occlusion model is removed, so that the ridge of the mandibular cast may be in clear view of the operator. The anterior tooth which served as a stop in registering central occlusion, and which was not intended to be set, then, in any specific occlusion, is placed back upon the carding wax.

**Principles According to Which the Posterior Teeth Are Always Placed.** The bicuspids and molars on one side are now placed in position. These should be so placed that a line drawn through the long axis of the tooth will pass through the crests of the maxillary and mandibular ridges. Fig. 73 is a schematic drawing illustrating this principle, and showing that even in the case of successive resorptions,

the principle still holds. In setting up the anterior teeth, the operator is directed in the largest measure by his regard for the esthetic effect. In setting up the posterior teeth, the operator is determined by a regard for the patient's comfort and efficiency in masticating his food. Accordingly, the posterior teeth are always placed upon the ridges in keeping with a single fundamental principle, namely, that force is exerted in a straight line and that this line forms a right angle with the origin of the force. It probably is not entirely superfluous to observe that, while in all cases the posterior teeth will be set up in keeping with this principle, the exact position of a tooth with reference to the ridge will not necessarily in one patient's mouth be identical with the position of a corresponding tooth in another pa-

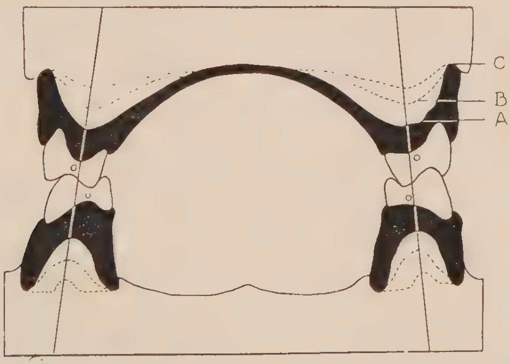



Fig. 73.—Bicuspids and molars should be so placed that a line drawn through the long axis of a tooth will pass through the crests of the maxillary and mandibular ridges. *A, B, C,* are intended to point out the fact that successive stages of resorption do not affect this principle.

tient's mouth. Fig. 74 shows the teeth of the maxillary ridge "off of the ridge." The mandibular teeth are on the crest of the ridge. Both are properly placed. The fact is, that the position of the teeth is determined in large measure with reference to the direction of the force of mastication, which in turn is influenced by the position and breadth of the base. The base of the upper extends, and includes tissues not usually regarded as supporting tissues under the stress of mastication. When regarded in this aspect, it is seen that the force of mastication exerted in a straight line does not pass through the crest of the ridge; consequently there is no reason in such instance to set the teeth directly upon the crest. Fig. 74 also shows a transverse section through the molar region of a duplicate maxillary which is shown in Fig. 151, page 186. Fig. 75 shows the position of the cusps

when active on the left side in mastication and on the right side in maintaining balance.

In the process of masticating, the force is applied along a line

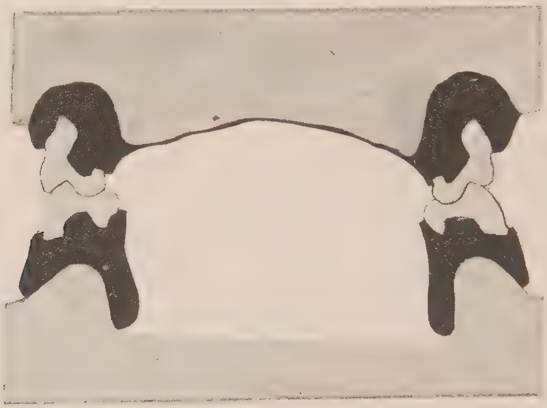


Fig. 74.—This figure shows that the reason for placing the teeth as indicated in Fig. 73 is that, when so placed, they are in the direct line of the force of mastication. Here it will be noted that the teeth are not placed upon the crest of the maxillary ridge and yet are properly placed. This is due to the fact that the base of this ridge includes tissues not ordinarily included as a portion of the base upon which a denture should rest. This change in base necessitates placing the teeth so that they are still in the direct line of the force of mastication.

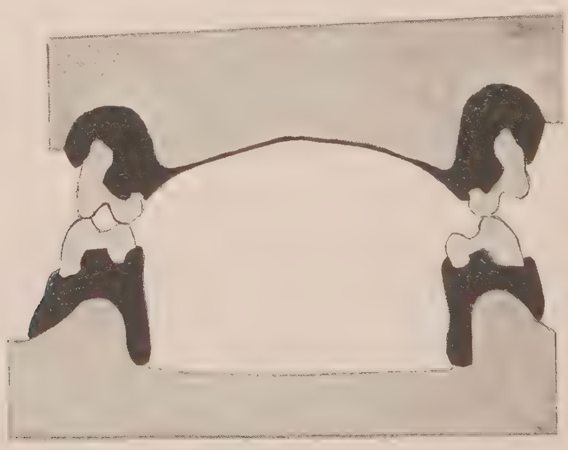


Fig. 75.—In this figure the position of the cusps is indicated when the left side is active in mastication, the right side is engaged in maintaining balance.

which passes through the long axis of these posterior teeth and through the crests of both maxillary and mandibular ridges.

The bicuspids and molars are set up on the opposite side in like manner.

**Method of Occluding the Mandibular Bicuspids and Molars.**—The mandibular model is now returned to its cast and sealed in position. The wax is cut off the mandibular base as in the case of the maxillary base. If any of the black carding wax is found upon the maxillary second bicuspid, it is blown away with blasts from the chip-blower and the holes are filled with melted base plate wax. After this preparation is made, the tooth is very closely and carefully occluded with the maxillary first and second bicuspids. In doing this the operator grasps the upper bow in his hand and inverts the articulator in order that he may have the advantage of gravity as well as a better view. With the smallest portion of wax necessary to attach the tooth, a

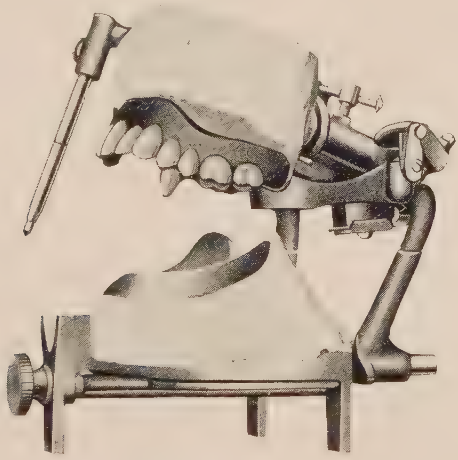


Fig. 76.—After the second mandibular bicuspid has been ground to intimate contact, it is sealed into position with a thin film of wax. When the articulator is closed, it assumes its correct alignment upon the mandibular base.

hot spatula is used to seal its morsal surface to the first and second bicuspids of the maxillary model (Fig. 76). The articulator is returned to its usual position and the upper bow brought down towards the lower. As it approaches the mandibular ridge the point at which it will touch is noted and the wax at that point softened, or if there is no wax there, it is supplied. The upper bow is now brought down until the mandibular second bicuspid is pressed into its position in the soft wax of the mandibular ridge. This tooth is now sealed permanently upon the mandibular ridge. The point of the chip-blower is held in the flame, then the collapsed bulb is freed and the air thus drawn in becomes heated, so that a blast from it, directed against the thin film of wax holding the bicuspid against the two teeth on the maxil-

lary rim, will release the bicuspid. When the bow is moved, the tooth will thus be left in correct position on the mandibular base. This tooth is now sealed securely.

The mandibular first molar is freed of black carding wax and the holes filled with melted base plate wax, and then occluded with the distal portion of the maxillary second bicuspid and the mesial portion of the maxillary first molar. It is sealed with a thin film of wax to these maxillary teeth and when the bows of the articulator are closed this tooth assumes its proper place on the mandibular ridge, where it is sealed securely and then released from the two maxillary teeth with a blast from the chip-blower. The second molar is occluded and then sealed in position in a similar way.

The second bicuspid and the first and second molars of the opposite side are then occluded and sealed in their respective places on the mandibular ridge.

**Occluding Mandibular First Bicuspids and Cuspids.**—With the articulator closed, one of the first bicuspids is freed of black carding wax and the holes filled with base plate wax and then placed upon some comparatively soft wax upon the mandibular ridge. It is then raised into its position of occlusion between the maxillary first bicuspid and cuspid. The cuspid on the same side is supplied with hot wax in similar manner and placed in position. The cusp of the mandibular cuspid is placed underneath the mesioincisal angle of the maxillary cuspid and the distoincisal angle of the maxillary lateral.

The first bicuspid and cuspid of the opposite side are set up by the same method.

**Sometimes Three Instead of Four Mandibular Incisors.**—The remaining four incisors are now placed upon the ridge and lapped or spaced as may be required to fill the space between right and left cuspids. The incisal edges of these four teeth are brought into occlusion with the palatal surfaces of the central incisors above. Then all of the six anterior teeth are pushed down toward the base until they lack at least one millimeter of touching the maxillary anterior teeth. While it is true that in the majority of natural dentures the anterior teeth are in contact whenever the jaws are closed, this kind of occlusion should be avoided in the case of artificial dentures, since the stress should be exerted in the bicuspid and molar regions. Often the space between the cuspids may best be filled by incisors selected from another set. If the space will not accommodate the *four* incisors which are carded with the set and three are not suffi-

cient, three wider ones from another set may be substituted advantageously. However, when the teeth in the wax are inserted for final approval, the patient's attention should be directed to the fact that one incisor has been omitted and the patient's approval of this omission should be secured.

**Final Approval Is Given by Both Patient and Operator.**—After the teeth are given their final position and the wax has been smoothed, the maxillary and mandibular models are both removed from their casts and the borders freed of any excess wax. They are then ready to be inserted in the patient's mouth to receive the final approval of patient and operator. At this stage it should be fully explained to the patient that this is the last opportunity to make changes in the alignment or size or hue of the teeth. The suggestion may also be offered that any fullness of lip or cheek may be modified by subsequent removal of vulcanite after the case is finished. Such suggestion, of course, will not be necessary except in instances in which the operator has insisted that, in his judgment, greater fullness than the patient regarded as becoming was necessary in order that subsequent adjustment of the lip might not unduly affect the facial contour.

The occlusion models are now placed on their respective casts and the base material along the borders sealed to the casts, and the articulator closed in order that the operator may note that the desired occlusion has been maintained. The casts are now removed from the articulator. After the overhanging edges of the plaster which lutes the cast to the bow are cut away, a knife blade may be inserted between the cast and plaster in order to separate them. A hammer or mallet should not be used, because the jar may loosen the teeth and disturb their alignment. Any additional wax required to permit the operator to carve the gums, is added, and the rugae reproduced either by carving, or with the use of one of the rugae patterns manufactured of tin for this purpose. If one of the patterns is used, the largest size may be adapted for any case. In adapting to the palatal portion of the base, any portion of the pattern which encroaches upon the anterior teeth may be trimmed with the scissors. The side on which the depressions of the rugae are found is covered with hot wax and when this has congealed sufficiently to permit the operator to press against the pattern without destroying the rugae (by flattening them out while pressing) it is pressed into position, then burnished down along its margins and sealed lightly with a hot spatula. The two extensions which are provided to imbed themselves

when the case is invested and thus hold the pattern in position while packing, are bent at an angle to the body of the pattern (Fig. 77).

**The Wax Is Carved so as to Make the Finishing of the Vulcanite an Easy Task.**—After the cases have been supplied with wax in sufficient bulk for carving, the final finish is given to the surface of the wax by very lightly projecting with the chip-blower a tiny flame against it until the surface has flowed smooth. (A tiny flame is very desirable for this purpose because with a larger one it is very easy to melt through the wax while using the flame for smoothing purposes.) Any solvent of wax, such as chloroform, for the purpose of smoothing the surface of the wax is contraindicated, because it leaves a thin film of wax upon the porcelain teeth. This film of wax prevents the plaster from attaching itself tightly about the teeth and thus often

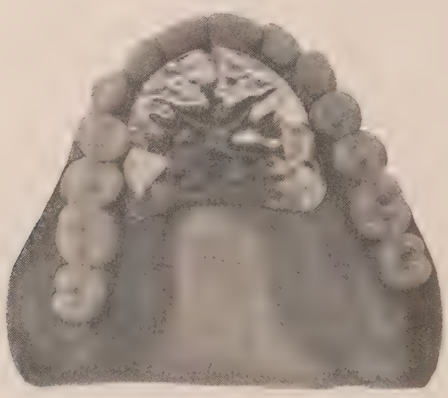


Fig. 77.—Placement of Steele's "Rugapak."

causes the teeth to drop out of place when the flask is opened for the purpose of removing the wax. A vulcanite chisel is used to cut a shoulder around the neck of each tooth wherever the wax touches it. The wax should not be allowed to extend down over the necks of the teeth farther than is necessary to provide in vulcanite sufficient material to permit the operator to carve a shoulder around them. When the wax extends too far, the vulcanite will require unnecessary carving—one stroke about the neck of each tooth should ordinarily be sufficient—and since this also leaves very little surface around which the plaster may cling, the teeth may not be held firmly enough to prevent them from falling out of their matrices. The shoulder should be cut with a free movement such as an engraver might use; this is in order that the shoulder may have a sharp border rather

than a feather edge extending down upon the tooth. The sharp border or shoulder serves as a ledge against which or upon which the rubber may stop and rest instead of following the feather edge down the tooth and thus permitting the rubber to act as a wedge between tooth and plaster, which often has a tendency to force the tooth out of its proper position.

**Flasking the Maxillary Cast and Occlusion Model.**—The maxillary cast with its occlusion model is now tried in the lower portion of a flask, and, if required, a sufficient amount of the cast may be cut away in order to assure an easy entrance into this lower portion. The upper portion of the flask is tried to make sure that the teeth do not project too high. Of course, this trial often is unnecessary since the operator may judge easily that the size of the flask will

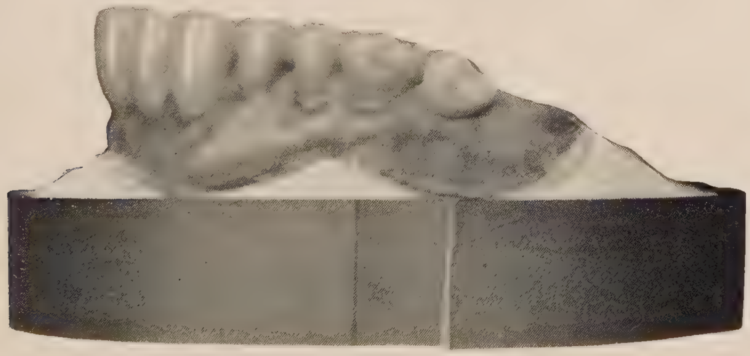


Fig. 78.—Maxillary cast with its occlusion model invested in the lower part of a flask.

permit the placing of a cast of the size at hand. The lower portion of the flask is partly filled with plaster—about two-thirds full—and the case then pressed into the body of the plaster and down until the border of the wax occlusion model is on a level with, or just a little below, the sides of the lower portion of the flask. Holding the case in the left hand, the operator may use the forefinger of the right hand to wipe off the excess plaster while it is still rather soft. When it has hardened somewhat, a brush—an old toothbrush may be used—is used to brush away any plaster that may be found upon the wax or upon the border of the flask. (Fig. 78 shows a maxillary cast and model invested in the lower part of a flask.) A separating medium is needed at this stage and soap is excellent for this purpose and is always at hand. The plaster portion of the lower part of the flask is soaped with heavy soapsuds; this is rubbed

into the plaster and the surplus lightly washed off. The upper portion of the flask is now placed in position and pressed down, taking care that it is in contact everywhere. This part of the flask is now filled with plaster. The plaster is poured into the posterior portion and then with the flask held in both hands, with the fingers between the flask and the bench, it is jarred into position. The anterior position is tilted slightly forward, thus permitting the plaster

Fig. 79.—The mandibular cast and occlusion model properly invested.

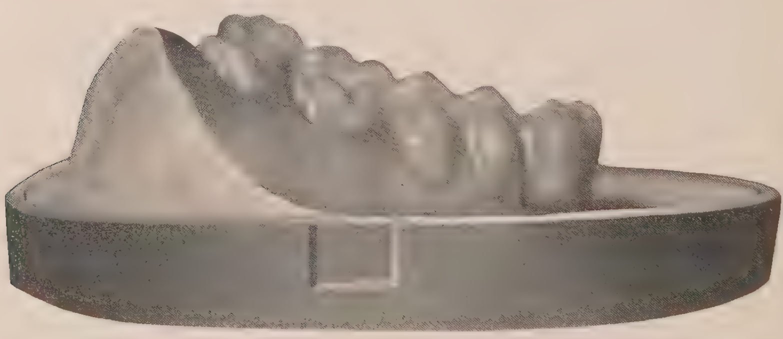


Fig. 80.—A mandibular cast and occlusion model improperly invested: the heels are too high and may be fractured in opening the flask.

to flow into the base from the posterior portion and along the palatal portion and up the other side of the walls, thus avoiding air bubbles. The flask is filled to the top and an excess assured, which will be squeezed out when the top is put on.

**Flasking the Mandibular Occlusion Model.**—The mandibular occlusion model is invested in practically the same manner. However, the

cast and pattern are set forward so as to provide ample room between the heels of the cast and the lower part of the flask. Fig. 79 shows the mandibular cast and pattern properly invested. Fig. 80 shows the case improperly invested; the heels are too high and may be fractured in opening the flask; in some places the plaster covers the wax, which may make it necessary to pack rubber in both portions of the flask, which, in turn, is liable to result in the base rubber flowing through the pink gum facing. Fig. 81 shows how a thin film of hot wax may be flowed over the heels of the Austin cast. This is to

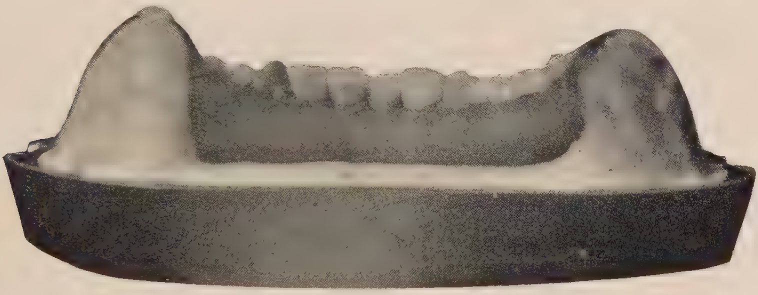


Fig. 81.—If the flask available is not large enough for properly investing a case, the heels of the cast may be protected by running a very thin film of hot wax over them.

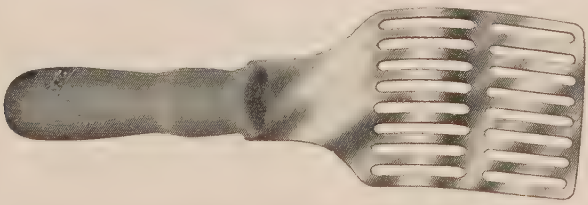


Fig. 82.—A flask lifter made out of metal potato masher.

protect them against fracture, when opening the flask. This is done when a flask large enough for properly investing is not available.

**Removing the Wax and the Base Plate Material.**—After the plaster has set (twenty minutes perhaps) the case may be lowered into boiling water and allowed to remain for a minute or a minute and a half (actual time) depending upon the size of the flask; the larger the flask, of course, the more time will be required. The operator will be enabled to determine the time required within a few seconds, after he has experimented a few times with his individual equipment. In no instance should the case be allowed to remain long enough to melt the wax. If allowed to melt, the melted wax entails an unnecessary amount of labor, makes the flask dirty and difficult to handle,

and softens the investing plaster matrix. If the wax melts and is boiled into the plaster matrix which holds the teeth the denture will not come out of the flask with a smooth surface. After the case has become heated enough to soften the wax, it is removed from the boiling water with a flask lifter (Fig. 82). A knife blade is inserted between the halves of the flask, first on one side and then on the other until the flask opens slightly; it is then grasped in the fold of a cloth, one portion in one hand and the other portion in the other hand and gradually opened. The wax and the Graft's base plate material should

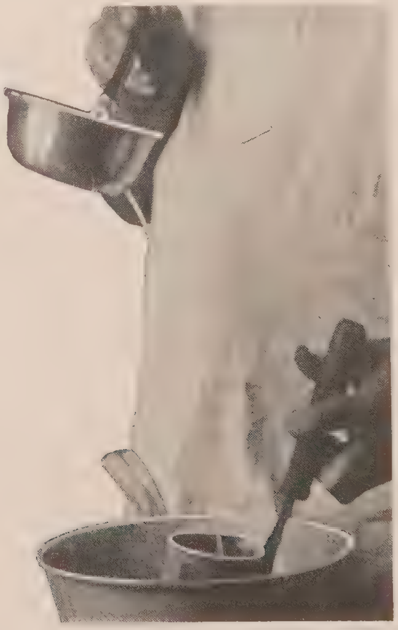


Fig. 83.—Dipper used in washing a cast clean of wax.

come out easily and leave the matrix clean. However, if a small portion of the melted wax remains, it may be expelled by dropping hot water from a dipper held twelve or fourteen inches above it (Fig. 83). A hole in the dipper is very convenient.

**Suggestions for Packing the Rubber.**—The cases are now placed upon the bench with their posterior aspect closest to the operator and are then ready to receive the rubber. A sheet of pink gum facing rubber is stripped of half of its starched protecting fabric and enough pieces ten or twelve millimeters in width to supply one of the cases are cut off with a pair of scissors. If the blades of the scissors are

moistened, they will cut the rubber more easily. One end of one of these strips is laid against the second molar on its distal surface and pressed into place with the moist thumb of the left hand, while the remaining portion is guided along upon the necks of the teeth until the median line is reached. As the thumb presses the rubber into place down toward, and almost into contact with, the pins, care should be exercised to keep the hands clean, since any grease or dirt will incorporate itself in the rubber, and in all probability will result in discolorations which will affect the final finish of the vulcanite. If the case is packed immediately after it has been removed from the hot water it will be warm enough to cause the rubber to adhere to the plaster matrix as it is pressed with the thumb. If granular gum pink rubber facing is used, it should not be stretched at any time, because the very purpose in using this kind of facing will be defeated by stretching. The mottled effect of the granular pink is due to the distribution of the white and red particles of rubber. In stretching, this distribution becomes unequal, elongates the particles, and results in an undesirable effect. A strip of rubber is applied to the opposite side in similar manner. As the rubber is pressed to place with the thumb, the outline of each individual tooth will show through this first layer of pink rubber. With a Woodson Amalgam Plugger (Fig. 84) used as a packing instrument, the broad flat end of the plugger is warmed in dry heat and the portion of rubber outlined on the tooth is cut away and turned over into the embrasures of the adjoining teeth. The end of the rubber strip near the region of the second molar should be left straight across so that when the red rubber is added from the region of the second molar to the extreme posterior portion of the base, the junction line will present a creditable appearance in the finished denture (Fig. 85). The case is supplied with additional pink rubber until the operator is satisfied that the contour of the case will contain more of pink rubber than of the darker base rubber. This is especially important in building thick contours because of the danger that the rubber will become porous in the process of vulcanization. The base rubber, or the dark rubber, or the rubber employed for the denture body—whatever phrase may designate this rubber, which is not employed as facing or for esthetic purposes—is cut into small strips about eight millimeters wide across the width of the sheet. A piece of this is folded once, making it about four millimeters wide, it is pressed together so as to exclude the air, and is then pressed under the pins of the anterior teeth by means of the


Fig. 84. A Woodson amalgam plugger is used as a packing instrument.

flat end of the plugger. Small portions of rubber are placed in the holes of the diatoric teeth and pressed down tightly; a larger strip of rubber is placed over the holes thus already filled, pressed down upon them with the thumb, and the strip extended to the anterior teeth and over the pins, thus covering up the rubber already supplied here and joining neatly with the pink rubber previously placed. One large piece sufficient to cover the palatal portion and approximately of the same shape as the palate, is split through its median portion and placed in position upon the palatal portion of the matrix and brought down and united to the base rubber along the border by pressing the

Fig. 85.—The pink gum facing is packed to form a creditable appearing junction with the dark rubber of the base.

edges against rubber which has already been placed with the plugger. The operator must now use his judgment in supplying other portions of the matrix which appeal to him as lacking sufficient rubber. At no time until the case is finally packed should the case have enough rubber in it. A sheet of starched cloth, which covers the rubber when purchased, is washed in hot water to free it of starch and is stretched over the matrix containing the rubber which has just been packed; the half of the flask containing the cast is settled into position and closed as tightly as it is possible to close it with the fingers. It is then placed in the Wilson Flask Press (Fig. 86). The lower portion of the screw of the press is provided with a volute spring so that

when the pressure is brought to bear by two or three turns of the handle of the press, a continuous even pressure will be exerted to close the flask while it is boiling in the water. The mandibular case is packed in practically the same manner as the maxillary. When the mandibular case has been packed and the cloth for separating purposes has been placed in position, the flask press is removed from the boiling water and the maxillary case taken out for inspection. While the maxillary case is being examined the mandibular is placed in the flask press and this in turn is placed in the boiling water where it is given a slight turn from time to time.


Fig. 86.—A Wilson flask press, with Wilson's volute spring which exercises a continuous even pressure.

**The Case Is Opened for Inspection and Further Packing, as Often as Necessary.** When the flask containing the maxillary case is opened and the cloth removed, portions of the matrix deficient in rubber are supplied, while any excess, which should be very slight at this time, is removed by cutting away against the margin of the matrix with a hot knife. Any surface of the rubber in the matrix which is not sufficiently united to obliterate the line of demarcation between the pieces of rubber, either of the same color or between the pink and the base rubber, should be supplied with a small piece of rubber the entire length of the deficient portion, because the rubber beneath that line may not have entirely united. The starchless cloth is inserted between the two halves of the flask and it is again closed and put

under pressure of the press in the boiling water. The mandibular case is treated in like fashion, care being taken in a case with a high heel, that the heel is not broken off when the case is opened. The case is supplied with additional rubber as the maxillary was supplied, after which it is returned to the press and the maxillary case is opened for the second time. If the operator has made a determined effort to assure an insufficient amount of rubber each time, the case, when opened this time, will have only one or two places which need to be supplied with rubber and possibly one or two places which need to be cut away even with the plaster matrix. These may be supplied

Fig. 87.—Case as finally packed, before final closing. Note absence of gates for escape of excess rubber.

or trimmed and the case closed again for trial, if in his judgment this additional trial is required.

**The Author's Method of Packing Is Intended to Avoid an Excess of Rubber.**—The object with this method of packing is to do away with any gates for excess rubber. In fact, an effort is made to pack the case so that there will be no excess of rubber. For that reason, the cases, each time when they are closed with the "trial" pack of rubber, should be closed tightly together. The final opening should show a very thin fin of rubber extending over the edge of the plaster matrix; this fin is cut away preparatory to the final closing of the

flask (Fig. 87). The cast should at this stage be provided with a relief chamber.

**A Relief Over the Hard Area of the Vault Is Made of Layers of Tinfoil.**—The relief chamber is obtained with the use of No. 60 tinfoil. A piece of this tinfoil is cut to the desired width and length, which will be about one-third the size of the desired relief; this is

Fig. 88.—The cast is provided with layers of No. 60 tinfoil in order to afford relief over hard areas.

lightly burnished into place upon the raphae or portion of the palate where the relief is desired. Another piece of tinfoil of the same thickness and two-thirds the size of the desired relief is placed over the first piece and this also is lightly burnished into place. Finally, a piece of tinfoil of the desired size and shape is placed over these two and lightly burnished into place (Fig. 88). The number of thicknesses used will depend upon the thickness desired. Over the final layer

of tinfoil used for the relief is placed a sheet of No. 4 tinfoil which is one one-thousandth of an inch thick (Fig. 89); this extends over the entire case and out a short distance upon the plaster matrix. The palatal portion is adapted first by pressing the tinfoil upon the relief pieces and then is burnished out toward the ridges, a soft cloth or towel being used as a burnisher. This operation is made easier by cutting the anterior portion of the tinfoil through to the region of the labial frenum and then allowing it to lap at this point. It is then pressed down over the ridges on both sides, continuing the brushing out-

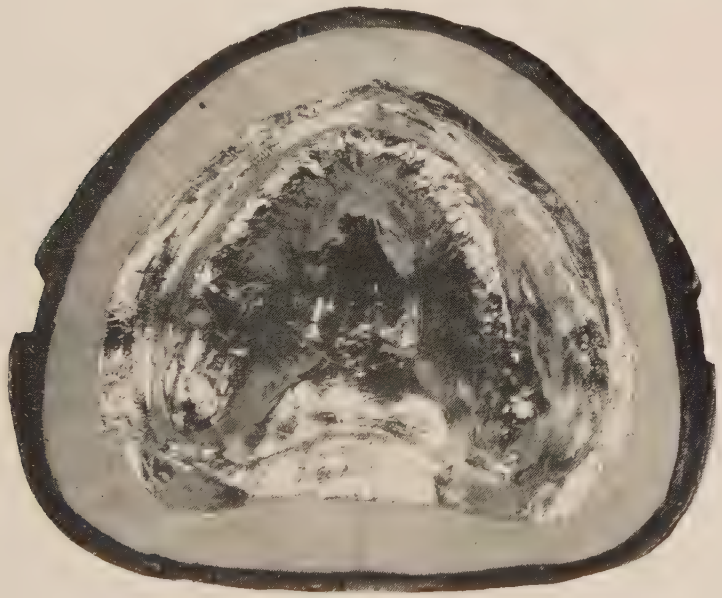


Fig. 89.—No. 4 tinfoil (one one-thousandth of an inch thick) is burnished over the cast in order to provide a metal finish against which to vulcanize.

ward in every direction and thus securing as few wrinkles as possible; the wrinkles which, without cutting it is impossible to eliminate, are burnished down with considerable pressure and then rubbed until the wrinkles virtually disappear. This will necessitate no little rubbing and also require considerable pressure. One thickness of a hand towel around the finger serves very acceptably for this purpose. The tinfoil is now rubbed with a thick lather of soap applied with the ends of the fingers. This will prevent the tinfoil from adhering to the vulcanite, when the operator is ready to remove it after vulcanizing. The flask is closed and put under pressure in the flask press,

where it is allowed to remain, while the mandibular case is being packed with rubber and supplied with tinfoil.

**After Tightening, the Donham Clamp Is Released One-half Turn.**—When both the maxillary and mandibular cases are thus prepared, the two are placed in the Donham Clamp (Fig. 90) and screwed down as tightly as is possible by means of the little bar provided with the clamp for this purpose. When the screw has thus been tightened, it is released one-half turn to allow for expansion of the rubber during the process of vulcanization; it is then ready to place in the vulcanizer. The Donham clamp, as well as the Wilson flask press, is manufactured

Fig. 90.—Donham clamp, designed especially for use in the vulcanizer with flasks which do not employ bolts.

by the Cleveland Dental Supply Co., Cleveland, Ohio. The author has found the flasks designed by Dr. Victor H. Sears of Salt Lake City most acceptable. This is because of the precise machined contact which compels an exact relationship between the parts when from time to time they are assembled. When used in the Sears' flask frame with the Wilson volute spring, the combination is almost ideal (Fig. 91). The American Dental Co., of Chicago, manufactures the Sears' frame and flasks.

**Springs May Be Used Instead of the Bolts of Bolt Flasks.**—If the operator wishes to employ flasks already on hand, he will find it advantageous to dispense with bolts and in their stead use "Little

Giant Flask Springs." These are made in four sizes, which are sufficient for all flasks; they are applied by means of an expanding tool which accompanies them (Fig. 92). (Manufactured by the Wichita Dental Mfg. Co., Wichita, Kansas.)

Fig. 91.—Sears' flask frame with Sears' flasks and Wilson's volute spring gives an almost ideal combination.

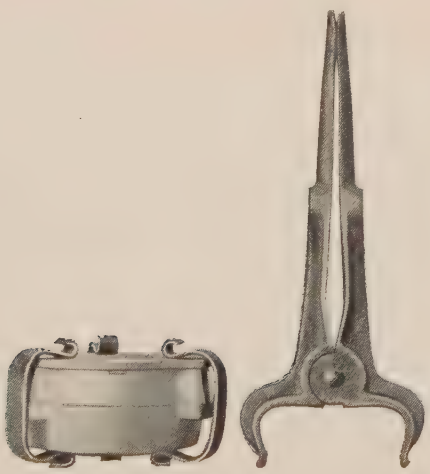


Fig. 92.—Little giant flask springs with expanding tool used in applying them.

**Vulcanizer Is Often Unnecessarily Tightened.**—Three or four ounces of water are poured into the pot of the vulcanizer, the flasks are placed within, and the top is placed in position—with the mark on the pot forming a straight line with the mark on the top. The rim of the pot should be wiped with the palm of the hand before the top is placed in positon;

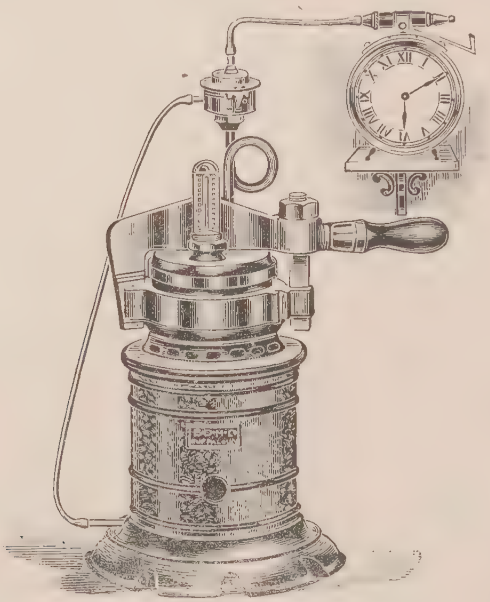


Fig. 93.—Lewis cross-bar vulcanizer with gas heating apparatus and No. 4 Lewis gas and time regulator.

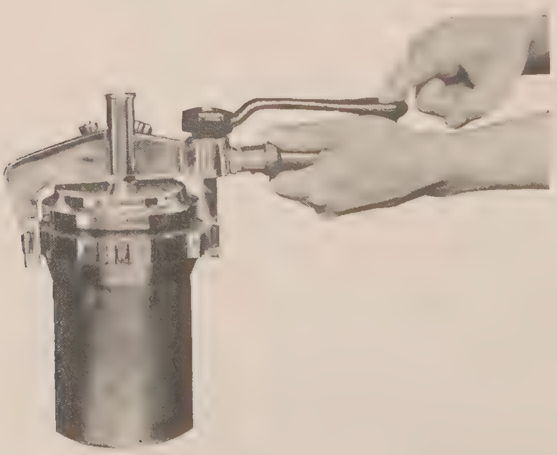


Fig. 94.—Force exerted with one finger is sufficient to close the vulcanizer. Closing more tightly than necessary is a common fault.

this will remove from the rim any particles which might interfere with a tight closing. The cross-bar is placed across the top and bolted into position and then screwed down as tightly as thumb and forefinger are able to tighten (Fig. 93), after which the vulcanizer wrench is placed upon the nut. Usually the force that one may exert by placing the forefinger through the hole in the handle of the wrench is sufficient to close a new vulcanizer, or to close one which has been given proper care during a number of years. Closing more tightly than is necessary has a tendency to compress the gasket, which is provided in the grooved portion of the top, until it loses its resiliency and gradually fails to serve the purpose for which it was intended (Fig. 94).

After the operator has noted that the blow-off valve is open, the fire beneath the pot is lighted and the flame adjusted so that a temperature of 320 degrees registers on the thermometer of the vulcanizer, within thirty to forty-five minutes after the mercury begins to show in the column. About the time the mercury begins to show in the column, the air in the vulcanizer will have escaped from the blow-off valve and steam will issue. The valve may now be closed. Often thumb and forefinger will be sufficient to turn enough to prevent leakage. If a wrench should be necessary, the slightest pressure should be employed—just enough to stop the escape of steam. Greater pressure will destroy the valve seat and often result in a permanent leak.

**Coordinating Gas Pressure, Gas Regulator, Thermometer and Thermometer Scale.**—If a gas regulator is to be used, both hands of the clock are set (for example), at one minute before twelve o'clock. The automatic gas lever may then be engaged in the beginning of the first turn of the screw portion of the automatic apparatus found on the shaft which carries the hour hand. The hands of the clock, as the lever remains engaged, are now turned backwards to register 11:00 o'clock, the hour at which the thermometer should stand at 320 degrees. The operator should then turn the hands backward thirty-five or forty minutes, the period of time which will be required from the moment the mercury appears until the water is heated to the temperature required for vulcanization, namely 320 degrees. Thus at 11:00 o'clock the temperature will be 320 degrees and this temperature will be maintained by the automatism of the clock for one hour. Accordingly, at 12:00 o'clock the lever disengages itself from the screw portion of the hour hand shaft and automatically shuts off the gas. The disc on the automatic gas regulator is set at 320 degrees on the degree plate of the gas regulator.

The figures just given are in most instances only approximate. Unless the operator is familiar with the working of this particular vulcanizer, he should make a trial in order to see for himself whether the thermometer will register 320 degrees when the gas regulator is set at the 320 degree mark on the disc. If he finds that the gas thus supplied when the regulator is set at 320 degrees is not sufficient to bring the thermometer up to 320 degrees, he should turn the regulator gradually to the right to increase the supply of gas so that upon second trial the flame will be hot enough to raise the temperature within thirty-five or forty minutes from appearance of mercury to 320 degrees. Accordingly, it may be necessary (depending upon the gas pressure, which may be considerably less in any particular town than in the city where the manufacturers coordinated the markings on the regulator with the reading of the thermometer) to set the gas regulator marker at 325 or 330 or even at 350 degrees, in order to get an actual 320 degrees.

**In Case a Thermometer Is Broken.**—The thermometers fitted by the manufacturers to the vulcanizers will register according to the thermometer scale provided by these manufacturers. However, thermometers are often broken and when a new one is inserted, its caliber, or its calibration, will probably not be the same as that of the old one; then by experiment only will it be possible to set the scale (already on the thermometer standard or upright) to correspond with the mercury at 320. A new scale should accompany each thermometer and this should be used, otherwise, it is possible that with the mercury actually at 320 degrees, as indicated by the mark on the *glass* column, the scale with numbered markings may show a reading of 300 or 360 or almost anything else. So, in actual operation, a gas regulator set to point at 340 to provide gas enough to vulcanize at 320 may be coordinated with a thermometer scale which at 300 records an actual temperature of 320. The author once had an alarm clock that, when set at twelve minutes past two always went off at fourteen minutes before six.

**Gas and Time Regulator Is Practically Indispensable.**—One of these gas and time regulators nevertheless, is one of the most profitable investments in the laboratory. It relieves the operator of the strain incidental to watching the vulcanizer and to keeping the flame properly adjusted, leaves him free to attend to any other duties, and actually does the work better than he can ordinarily do it. It may be left at night with the assurance that the case will be vulcanized when

the operator returns in the morning and that the gas will not have been burning all night. In buildings where gas is not available an electric vulcanizer may be used (Fig. 95).

When the vulcanizing is finished, the protecting cap is replaced upon the thermometer.

**How to Open Vulcanizer Quickly.**—If the operator desires to open the vulcanizer as soon as possible after vulcanizing, the rubber tubing

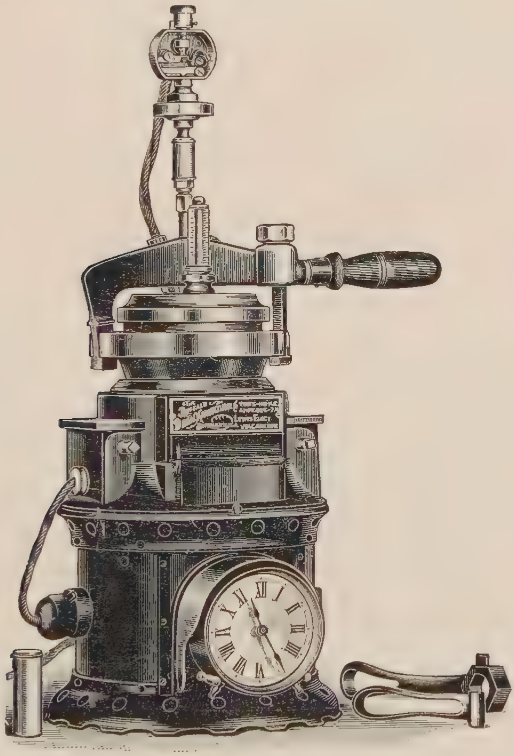


Fig. 95.—Lewis automatic electric vulcanizer.

is disconnected and the vulcanizer removed from its supporting jacket and placed under a very small stream of water until the steam resulting from contact with it no longer arises. Then a generous stream of water may be allowed to fall upon the top until it is no longer warm and may be handled with the bare hands without discomfort.

**Dry the Top and Cross-bar.**—When bolt and bar are removed, the lip on the vulcanizer wrench is inserted between the lid and top of

the vulcanizer and the top pried off. The pot is now set under the running water that the flasks may be further cooled. The top and cross-bar are wiped dry and laid aside in condition to be used again.

**Allow the Flasks to Cool Before Opening.**—The flasks are allowed to remain in the water until, when removed, they are cool enough so that water on them is not vaporized, but instead clings to them. They are released from the Donham Clamp and the edge of a knife is inserted between the halves of a flask; either the upper or the lower portion will separate intact without disturbing the plaster matrix. The case is now put into cold water while the other flask is opened. The flask may be separated from the bulk of plaster containing the denture, by tapping the flask with a horn or rawhide mallet. A not uncommon procedure is to batter the flasks with the use of the vulcanizer wrench, until finally they are not fit for use. The use of one of these flasks which is not fit for use is one explanation of the discrepancy in occlusion between that of the case in the wax and that of the case after vulcanization. Before the dentures are divested of plaster, the flasks are scrupulously cleaned with a stiff brush, dried, assembled, and laid away for future use.

**Danger Resulting from Opening Before Cooling.**—The technic as given above, with the emphasis placed upon the practice of cooling the case thoroughly before removing from the flask, will avoid much grief. If the case has not been thoroughly cooled, the heat within the center of the flask, when its pressure is released, expands and thus distorts the plaster matrix and the hot pliable vulcanite. This may take place without any explosion and unaccompanied by striking phenomena of any kind, but the net result of failing to cool the case thoroughly before opening, is usually an unsatisfactory denture. The operator will note the unsatisfactory result most, perhaps, when the dentures are finished and fail to seat properly.

**Removing Plaster and Tinfoil from the Vulcanite.** The plaster is broken, cut, and brushed away while holding under running water. Care is used in removing the Austin casts. The tinfoil may now be easily removed by means of a dull vulcanite scraper, provided the operator has not neglected to soap it before closing the flask. If, through failure to soap it, the tinfoil clings tenaciously to the vulcanite the major portion should be scraped away with a dull scraper; then a small mass of amalgam may be mixed and used to remove the small particles remaining. If the mass of amalgam is rubbed against these particles of tinfoil, they will become incorporated in it. Any minute portions

of plaster remaining may be removed with a brush wheel on the lathe, using wet pumice for this purpose.

**A Dust Collecting Polishing Unit Is Valuable.**—Besides many individual lathes, the author finds a unit such as shown in Fig. 97 a very

Fig. 96.—A cheap stiff bristle brush useful in cleaning flasks and for many laboratory purposes.

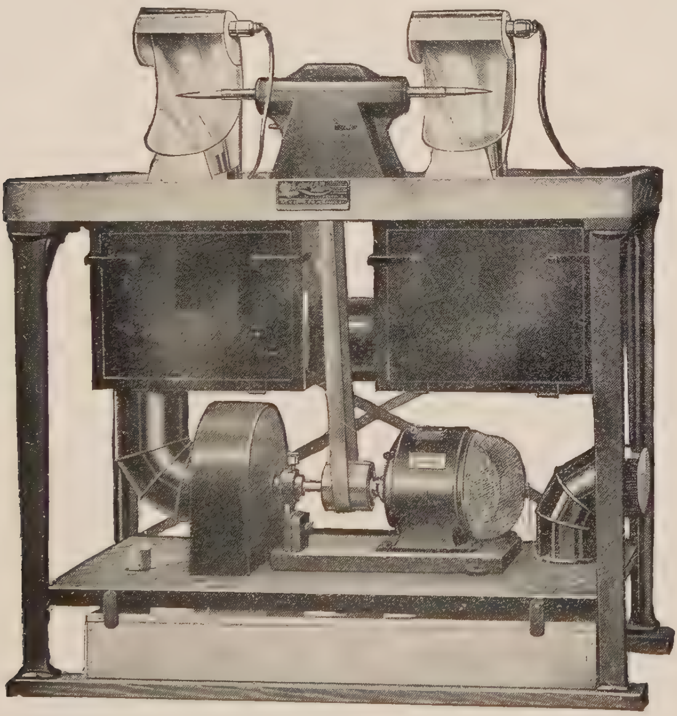


Fig. 97.—Model *A* polishing unit.

valuable asset, because of its dust collecting feature. It is manufactured by Leiman Brothers.

**Employ a Continuous Movement of the Chisel in Carving Around the Necks of the Teeth.**—Right and left cutting vulcanite chisels (Fig. 98) are used in trimming around the teeth. The chisels should

be sharp and have an edge finished on an oilstone instead of emery or carborundum. With a sharp chisel it is possible to make the cut around the neck of each tooth with a continuous movement from the embrasure of one tooth to the embrasure of the adjoining tooth. This leaves a clean, sharp, and almost finished margin. With such margins as single cuts produce, polishing between the teeth, which is the most difficult part of the polishing process, is greatly facilitated.

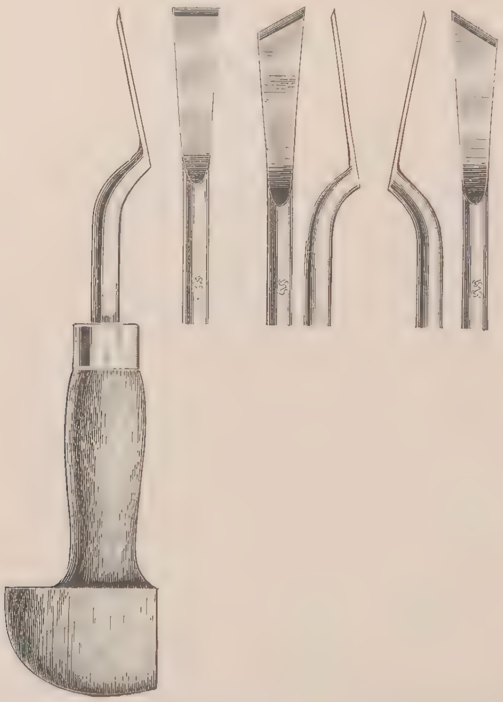


Fig. 98.—Pearson's vulcanite chisels are used in trimming around the teeth. Right and left angle chisels as well as straight edge chisels are employed.

If the rubber has been packed in a plaster matrix free from all wax, the case may be finished without the use of sandpaper. If, during the process of separating, the case has been heated too hot while removing the wax, some of it probably will have become incorporated in the plaster, resulting in a surface which is not sufficiently hard and smooth to give a smooth finish to the vulcanite. In such cases, the Ritter sandpaper chuck (Fig. 99) and the Crocker "Ideal Emery Cloth Arbor" (Fig. 100) are used to finish the vulcanite preparatory to using the pumice.

In using the sandpaper (Nos. 0 and ½) on the Ritter chuck, it will be found that a knife held against it while revolving (Fig. 101) will quickly provide a fresh piece with an end flexible enough to find its way easily into the interstices between the teeth, and be very serviceable in the case of deep vaults.

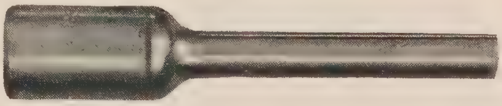


Fig. 99.—Ritter sandpaper chuck.

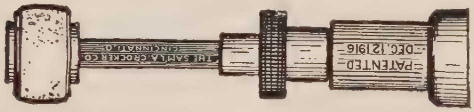



Fig. 100.—The Crocker "ideal emery cloth arbor" carries bands of emery cloth which are easily and quickly replaced as they are worn out.

Fig. 101.—When the sandpaper of the Ritter sandpaper chuck is worn, a knife is held against the revolving paper near the end of the chuck. The sandpaper is then moved outward as desired, and this operation repeated until the length of sandpaper is entirely used.

**Finishing and Polishing.**—An abundant supply of No. XXX pumice flour is put into the vessel (Fig. 102) beneath the taper screw chuck of the lathe. For polishing in the embrasures a stiff four-row brush wheel (Fig. 103) is most effective. In using this brush on the lathe, it is very important to employ the rotary motion in pressing

the denture against the wheel; not only is this motion important, but the direction of the bristles should seldom be parallel with the embrasures—they should be obliquely directed first against one side of the embrasure and then alternately against the other. This prevents the cutting of grooves instead of smoothly polished surfaces. A

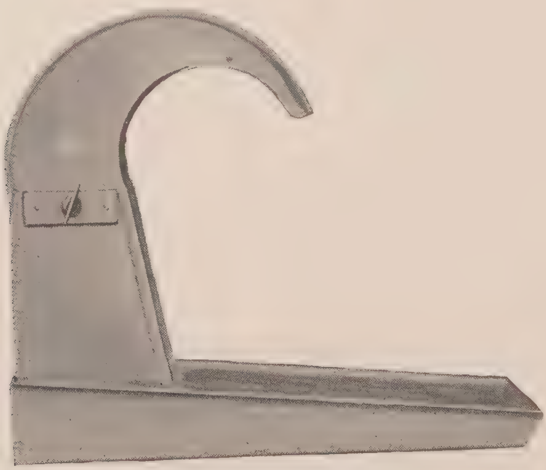


Fig. 102.—A lathe splasher of this type protects the worker and is especially valuable in grinding precious metals.



Fig. 103.—For polishing in the embrasures a stiff four-row brush wheel is most effective.

four inch forty-ply rag wheel (Fig. 104) is put upon the chuck, and with the lathe running at highest speed, the vulcanite along the broad and easily accessible surfaces of the denture is cut down to a polished surface. The pumice should be mixed with water to a creamy consistency and should be applied in abun-

dance to the denture, which is immediately thrust with considerable force against the rag wheel. The denture should be grasped firmly in both hands and the force with which it is pressed against the wheel should be sufficient to slow down very perceptibly the motor

Fig. 104.—A four-inch forty-ply rag wheel is used with pumice and other polishing materials.

Fig. 105.—A small felt cone will gain access to places such as deep vaults.

of the lathe. As the lathe slows down, the denture is momentarily withdrawn while simultaneously the right hand is released in order to dip into the pumice and apply it, when again the denture is pressed against the rag wheel. If the operator will press the den-

ture with a circular or rotary movement up against the wheel in reverse direction to that in which the wheel is running, he will avoid polishing too deeply or causing marks which need to be obliterated through further polishing. While the polishing extends over the border of the denture, the border is not perceptibly cut away; it is polished, but the same care is exercised to preserve this border as has been taken throughout the construction of the case. With many dentures, on account of deep narrow vaults, the rag wheel cannot be used to polish the palatal portion. Any inaccessible portions of this kind may be reached with pumice applied by a small (½ inch) felt cone (pointed) on the lathe (Fig. 105). If this cone is not tightened


Fig. 106.—The brush wheel with cup-shape bristles is also serviceable.


Fig. 107.—The converging bristles brush wheel.

upon the mandrel too far the tip of the cone will have a flexibility which will enable the operator to polish some otherwise almost inaccessible portions.

**Put on Wheels with Wooden Centers, While the Lathe Is Not Running.**—While a rag wheel or felt cone may be put upon the screw mandrel while the lathe is running, perhaps more easily than if it were still, it may be helpful to suggest that the brush wheels, which have wooden centers, will seldom be broken if, when first put on, they are put on before the lathe is started. The wood should not at any time be allowed to become soaked with water, because after this takes place the wheels are easily broken. Two other helpful brush wheels are the cup-shaped one in which the bristles diverge to form

a larger circumference extending in front of the center or hub in which they are set (Fig. 106), and the converging bristles brush wheel (Fig. 107).

**Final High Polish Given with Chalk or Fine Silex.**—The final high polish is given to the denture with a rag wheel and prepared chalk or a fine grade of silex. These are mixed with water and applied in the same manner as described for pumice. The vessel and rag wheels should be used with this polishing material only and should not be mixed with the pumice.

The dentures are now washed and scrubbed with a hand brush in running water. Thin lines or minute particles of vulcanite are removed from between the teeth by means of a fine pick or a portion of a ribbon saw.

**Powdered Gum Tragacanth Assists the Patient in Becoming Accustomed to Dentures.**—When the dentures are thus ready for a patient who has never worn dentures, the operator should sprinkle very lightly upon the moist bases some powdered gum tragacanth. As the operator sprinkles this powder upon the bases, he should advise the patient that its use is to enable him to retain the dentures securely during the first few days while the tissues of the mouth are becoming adapted to the new dentures, and that within a day or two he will find that he will be able and glad to abandon the use of this sticky preparation.

**The Dentures May Be Worn a Week Before Grinding with Carborundum Powder.**—After inserting the dentures, the operator will note the occlusion. If the technic as described has been carried through with care and precision the occlusion will be the same as when the case was tried in the mouth while the teeth were set up in the wax. The patient is now permitted to wear the dentures for a week or ten days or until the patient has become accustomed in a measure to their presence and use. At the end of this time the operator may safely assume that the dentures are well seated and that he may now perfect the occlusion by grinding with carborundum powder.

**Carding Wax Is Employed in Detecting Imperfections in Occlusion.**—Preparatory to final grinding, the occlusion is improved as much as possible in the following manner: In order to disclose imperfections in occlusion a layer of black carding wax is placed upon the occlusal surfaces of the teeth of the mandibular denture and the patient requested to close upon it. The surfaces of the teeth should be dry so that the wax will adhere when pressed down upon them

and over the buccal, labial and lingual borders. For this purpose the wax is softened over a flame and made into a roll which, when flattened, forms a layer two or three millimeters in thickness and wide enough to cover the teeth as described. This layer is placed upon and covering the entire occlusal surfaces of the molars on one side, extending back upon the vulcanite distal to the second molar and continuing over the incisal edges of the six anterior teeth and around to the molars, extending over and upon the vulcanite as on the beginning side. It is cut off by pressing the thumb against the wax at the heel on this concluding side (Fig. 108).

**Summary of Advantages.**—The black carding wax is employed because of these three advantages: (1) In cases in which the muscles of mastication have little strength, this wax at body temperature offers little resistance. (2) It covers all of the cusps so that any irreg-

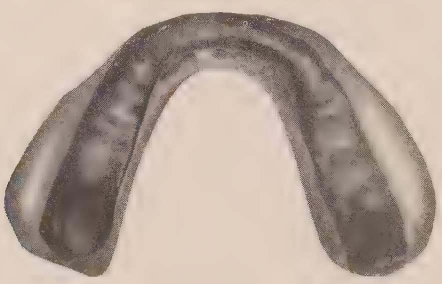


Fig. 108.—A layer of black carding wax upon the occlusal surfaces of the mandibular denture ready to be inserted so that the patient may close upon it for the purpose of disclosing any imperfections in occlusion.

ularity of a single cusp may not determine the final closing movement of the mandible. (3) Its dark color is in marked contrast with the color of the porcelain teeth.

With the black carding wax in position on the mandibular denture it is inverted and passed through the flame so that it may be uniformly heated. The denture is placed in the mouth (the maxillary denture being already in place); the operator closes his jaws with a click and the patient will imitate the movement. While the patient's jaws are closed, the black wax in the bicuspid region is cut away so that the operator may note whether the closing movement has been entirely completed and is satisfactory, that is, registers central occlusion. If the closing movement is not satisfactory, the mandibular denture is removed and any point of the occlusal surfaces of the teeth that may have been so high as to prevent the teeth from coming entirely together in central occlusion, is corrected. This is

done by cutting out with a small mounted stone in the hand piece, the opposing surface. This is preferable to cutting off the high point of a cusp, because to cut off the high portion will tend to destroy the shearing action of the dentures in lateral excursions of the mandible.

If a cusp of a mandibular tooth has been denuded (through this closing), a corresponding portion of the sulcus of the maxillary tooth must be ground out to accommodate it. If a sulcus of a mandibular tooth is denuded of wax, it is further ground out while the black wax is still in position. If the wax has been very badly distorted or macerated, it is sometimes advisable to remove it and form it into a roll and proceed as from the beginning. However, the operator may very frequently use the chip-blower and the gas flame to soften the wax as it remains in position on the teeth and thus restore its surface preparatory to repeating this operation for perfecting the occlusion.

**Three Distinct Areas of Close Contact Are Desired.**—At least three distinct areas of close contact at widely distributed intervals on the occlusal surfaces are to be desired. Without at least three areas so separated and constituting the plane of occlusion, the plane cannot as yet be properly said to exist in these dentures, except theoretically. Unless three areas of this kind are established, the patient will close with more stress upon one side of the dentures than upon the other, and if they are allowed to remain in this relation while they are being ground to this final occlusion, the occlusal surfaces on one side of the dentures will be ground away more than those on the other side, and this will be continued during mastication. A fine-pointed instrument, such as an explorer, is very helpful in detecting the porcelain through the black wax. This is true at points where the black wax has been pressed very thin—so thin that it is not always distinguishable from the white of the porcelain that may be piercing the wax. Any points, which the operator has reason to believe may be points of this kind, are lightly probed with the instrument and contact thus felt even though it is not perceptible to the eye. When these three areas are obtained (Fig. 109), the maxillary denture is placed in the impressions of the black wax upon the mandibular and both maxillary and mandibular dentures are sealed together with hard wax and then mounted upon the articulator.

**Wet Tissue Paper Facilitates Removal of Dentures from the Articulator.**—Before mounting upon the articulator, the space that is to be occupied by the tongue is filled with wet tissue paper. The paper is placed in the vault of the maxillary denture and built up even with

the lingual border of the mandibular denture (Fig. 110). This provision is to facilitate easy removal from the articulator; the paper prevents the plaster, used in luting to the articulator, from encroaching upon the lingual portion of the mandibular denture. Any undercuts in maxillary or mandibular denture are now filled with tissue paper for the same purpose.

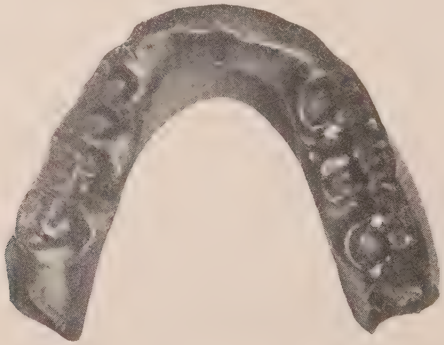


Fig. 109.—White spots indicate the porcelain showing through at these points after the patient has closed upon the carding wax.

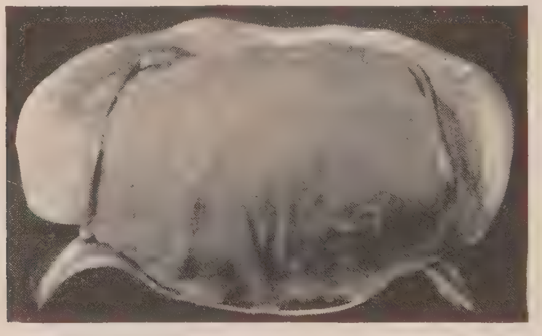


Fig. 110.—Before mounting upon the articulator for final grinding, the space that is to be occupied by the tongue is filled with wet tissue paper to facilitate removal.

**Grinding for a Possible Retrusive Movement.**—In order to make it possible later to grind the teeth for a possible retrusive movement—which movement may be peculiarly characteristic of a patient—a piece of base plate wax is now placed between the posterior portion of the lower bow and the base of the upright portion of the frame (Fig. 111). This piece of wax is about five centimeters in length and one centimeter in width; when it is later removed, the lower bow may be retruded a distance equal to the thickness of the wax (three millimeters). The author is indebted to Dr. M. M. House of Kansas City for this suggestion.

**Author's Attachment Is Used.**—The Gysi Simplex Articulator, fitted with an attachment designed by the author, is used in grinding. This attachment makes it possible to protrude and retrude the lower bow at will of operator and with the desired precision. This attachment is shown in Fig. 111.

**Luting Dentures to the Articulator.**—The plaster is mixed and poured upon the lower bow of the articulator, then into the mandibular denture and over the tissue paper. With the plaster stiff enough to sustain the weight of the two dentures, the two are inverted and

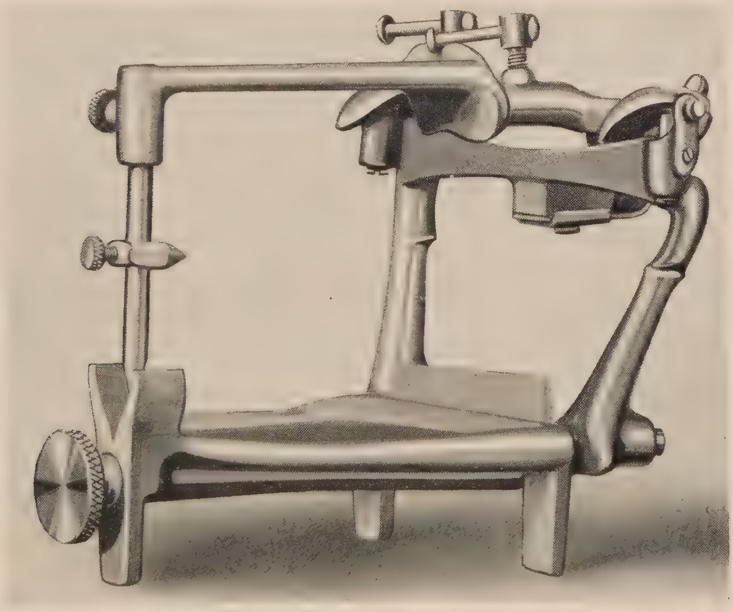


Fig. 111.—A piece of wax three millimeters thick, placed between the posterior portion of the mandibular bow and the base of the upright portion of the frame, makes it possible to grind the teeth for a possible retrusive movement.

the mandibular denture pressed down into the plaster upon the lower bow; pressure is continued until the mesioincisal angle of the two centrals of the maxillary denture barely rest upon the occlusal plane marker of the incisal guide pin; the occlusal plane of the dentures should be parallel with the occlusal plane of the articulator as indicated by the marks on the articulator. When the plaster on the lower bow is hard, the tissue paper is removed and the black wax is examined to make sure that the maxillary denture has not been displaced during the operation involved in mounting the mandibular

denture. The maxillary denture is now filled with plaster and the upper bow with its incisal guide pin is lowered into position. The operator is cautioned to bring the incisal guide pin to rest in its lowest position in the incisal guide cup. Sufficient plaster is now added on top of the upper bow to hold the case firmly.

**No. 90 Carborundum Powder Mixed with Glycerine Is Used.**—When the plaster is hard, the case is opened and the black wax removed. The discrepancies in the occlusion are now presented in full view. No. 90 carborundum powder is mixed with glycerine and applied to all of the occlusal and incisal surfaces of the teeth of both dentures; the mixture should be thick enough to adhere to the teeth

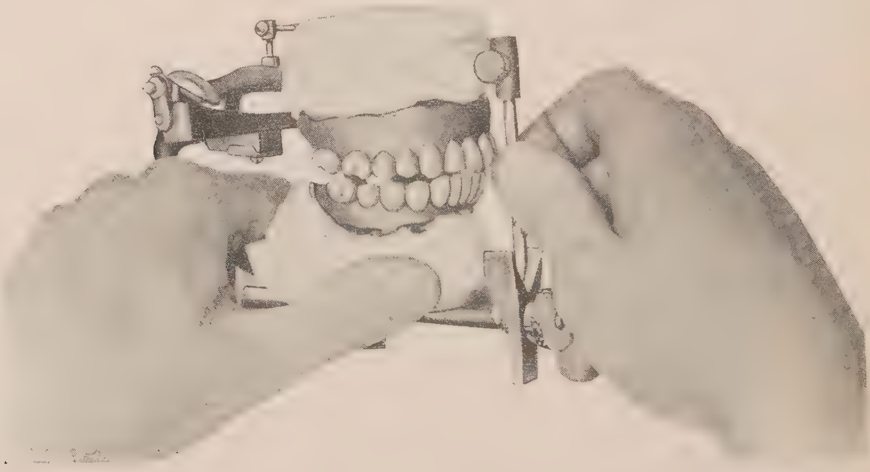


Fig. 112.—In grinding, the operator grasps the incisal guide pin in the right hand, while holding the articulator with the left.

without running off too rapidly. If the carborundum is mixed with glycerine and allowed to stand a while and the excess of glycerine then poured off, the mixture will be of the proper consistency. The carborundum powder may be obtained of any hardware dealer.

**Operator in Grinding Is Guided by Sense of Touch.**—In grinding, the operator grasps the incisal guide pin in the right hand while holding the articulator with the left (Fig. 112); the pin is raised to the highest point in the guide cup and as it is held against the side of the cup, it is brought down to the bottom of the cup; this movement is repeated six or seven times, after which the pin is moved to the opposite side of the cup and the movement continued for the same number of times. The operator will be guided by his sense of touch

and by the grinding sound of the grit as it cuts the porcelain. This will be very slight at the beginning of the grinding operation and often will be detected upon one side only; when the operation has continued with the sides alternately as just suggested, until the sound of cutting is no longer heard and there is no evidence of it to the operator's sense of touch, the screw at the top of the incisal guide pin is loosened and the incisal guide pin is raised perhaps one millimeter, after which another "cut" may be made. It is not wise to raise the guide pin more than a millimeter after each "cut" because when raised more than this, the pin will not follow the sides of the cup so well and the planes of the cusps of the teeth will not be cut true to the angle represented by the guide cup. The grinding is continued until the teeth are in the desired contact throughout the excursion from extreme lateral to central occlusion. The operator may note this to best advantage after he has washed off the carborundum mixture and has thoroughly dried the teeth. Then, when he repeats the movement used in grinding he will have a clear view of the contact maintained throughout.

**Lower Bow Is Gradually Moved Forward and Backward.**—The thumb screw beneath the guide cup is now turned to the left, bringing the lower bow forward until an "end-to-end" occlusion is established. Often the anterior teeth will not come together in such occlusion, because the distal portions of the mandibular second molars strike the posterior teeth of the maxillary denture too quickly. With a piece of carbon paper these points are marked and are then ground away with the use of a small carborundum wheel, until some one point of the incisal edge of the upper anteriors will touch a point on the mandibular anteriors. The carborundum mixture is again applied and the guide pin raised out of the guide cup until it may be kept free from touching the cup during the right and left swinging movement used to grind down the teeth sufficiently to give a balanced contact, which is such contact as in the mouth prevents rocking or tipping of the dentures. Gradually the thumb screw is returned to position and at intervals during this return the grinding is continued until any cusps which interfere with an anteroposterior movement are cut off. After the case is returned to its farthest posterior position, the screw is turned to bring it again to the "end-to-end" relation of the anterior teeth and again returned to the posterior position, continuing the grinding at intervals in order to smooth the cut made the first time.

**Grinding for a Possible Retrusive Movement.**—The wax between the lower bow and the base of the upright frame is now removed and the lower bow is screwed back against the base, while the grinding is continued at intervals as described above, until the operator may move the dentures in occlusion without cusp interference.

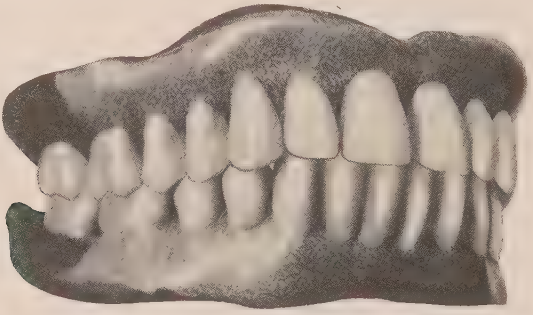


Fig. 113-*A*.—Finished dentures.

Fig. 113-*B*.—Patient wearing finished dentures.

The case is again ground as described above, but the second time a finer grade of carborundum (No. 120) is used. The grinding operation is finally completed with the use of pumice stone mixed with water. The case is now removed from the casts and any "saw-tooth" edges of the teeth are ground down with a medium garnet disc in the handpiece of the dental engine. Fig. 113-*A* shows the completed dentures ready for insertion. Fig. 113-*B* shows patient wearing them.

**Results of Automatically Grinding Otherwise Finished Dentures Are Usually Very Gratifying.**—When the dentures are inserted, it is not unusual to find patients—especially those whose natural teeth were characterized by a deep overbite and whose teeth have only recently been removed—able almost immediately to reproduce any habitual masticatory movement. The dentures should now be finally tested in order to see whether they are correctly balanced. Occasionally it will be found that a wide movement of the mandible ex-

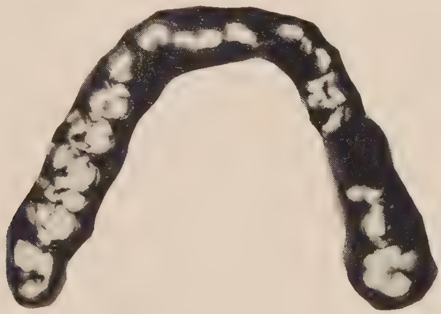


Fig. 114.—A piece of base plate wax showing imprints of natural teeth (one tooth missing) after patient has closed upon it.

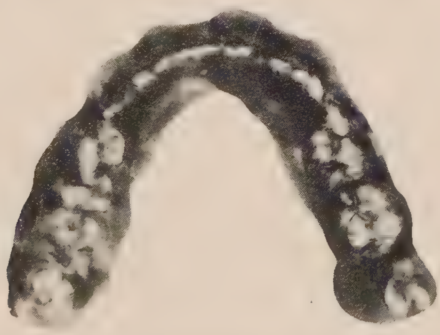


Fig. 115.—Base plate wax showing imprints of artificial teeth after they have been automatically ground to perfect the occlusion.

traneous to the normal masticatory range will cause the maxillary base to move slightly. With a piece of carbon paper, the high cusps may be ascertained and reduced. The author has found no articulator that will in all instances obviate the necessity for this final adjustment in the mouth.

**Comparison of Natural Occlusion with That of Artificial Dentures.**—Figs. 114 and 115 present in comparison pieces of base plate wax showing the kind of occlusion registered by natural teeth and that registered by the teeth of artificial dentures after these have been ground as described.

## CHAPTER II

## SOME PSYCHOLOGICAL PHASES OF FULL DENTURE PROSTHESIS

**The Actual Construction of an Artificial Denture May Be Left Wholly to the Laboratory Technician.**—This is especially true of the technic followed by the author, since the anterior teeth are selected and arranged at the time of securing central occlusion. If an intelligent and skillful mechanic is provided with pattern and definite instructions, he can supply a satisfactorily constructed denture, equally as well as the jeweler's assistant can finish at his bench a beautifully designed emblem. He may proceed as definitely as the civil engineer who follows the blueprint and builds abutments and spans rivers.

**Prosthetist's Constructive Work Is also Psychological.**—However, when the emblem or crest is finished, the jeweler's work of construction is done; when the engineer has swung his bridge across the space, he moves on—the prosthetist, when his mechanical work is completed, still is confronted by conditions which may set at nought matchless workmanship and render useless the highest product of his skill. To compare his problems with those of the others, we should think of the engineer endeavoring to rest his abutments upon foundations which change their character with the setting of the sun, or we should think of the creation of synthetic pearls, whose delightful lustre depends in part upon the health of the wearer upon whose bosom they rest.

**Success in Prosthesis Depends upon Both Patient and Prosthetist.**—The prosthetist's success depends upon the success of his patients in wearing the dentures which have been constructed. The division of the spoils of victory might be suggested as 50 per cent to the one who constructs the dentures and 50 per cent to the patient who wears them. Actually, the prosthetist may be entitled to an additional share. Let us say that he may be entitled to one-half of the patient's half of the success, because the prosthetist's skill was required in order to secure from the patient the maximum results. "How to secure such cooperation from the patient that the prosthetist's skill may yield the maximum results," might well be the title of this chapter.

**What Psychology Is.**—While it is true that the problem of denture construction is a problem of mechanics, and that the problem of denture retention is fundamentally a problem of physics, the problem of the patient's adaptation to the denture is largely a problem of mental processes. The science which deals with these mental processes is psychology; the author's special interest in this science is limited to its application in the realm of denture prosthesis. In particular, this chapter deals with the art of employing a knowledge of the mental processes—a knowledge of the likes and dislikes, the biases and prejudices, the ambitions and aspirations, the fears and confidences, the clear stream of rational thinking and the unreasoned habits and attitudes—of individuals, who seek the prosthetist's services in securing for themselves satisfactory artificial dentures.

**Specialist Usually Starts with Patient's Confidence.**—Usually the specialist has an advantage which the general practitioner may or may not have. The patient goes to the prosthetist with the confident expectation of securing superior results. Of course, in order to secure the continuance of this initial confidence the specialist must be qualified to render superior service, which, in many instances, consists largely in encouraging the continuance of the confidence which brought the patient to this office instead of to another. However, its continuance must not be encouraged in any way that may tend at any stage to relieve the patient of his full share of responsibility.

**Integrity of Prosthetist Should Be Only Guarantee of Satisfaction.**—Several years ago when the author was just beginning to specialize in full dentures, he sought to encourage confidence in his ability to render satisfaction, through the use of an appointment card. On the reverse side of this card was printed a list of fees and just beneath appeared this sentence: "It is distinctly understood and agreed that should the dentures prove unsatisfactory sixty days after their completion, four-fifths of all money paid shall be returned upon receipt of the dentures." The use of this type of encouragement was discontinued because he decided that its use encouraged the patient to expect satisfactory dentures *or* the return of the fee; there should be no alternative in the mind of the patient—he should be expecting satisfactory dentures. Now nothing is said about the return of the fee; the author insists that the patient must be satisfied; other patients have been satisfied, and it is such satisfaction which has built his practice. Until the dentures are satisfactory the prosthetist's services are not completed, and he will welcome opportunity at any time to render them as satisfactory

as the patient expects them to be. When sufficient time has elapsed to enable the patient to profit fully by the prosthetist's services—psychological included—and the prosthetist finds that his efforts and the patient's cooperation are not sufficient to produce satisfaction, then the whole amount of the fee should be returned. Its return will undoubtedly surprise the patient, and he will not unlikely prefer the dentures to the refund, especially if he has been impressed with the prosthetist's integrity and has concluded that the degree of satisfaction already attained is preferable to a prolonged series elsewhere. The refund is made cheerfully. The patient's confidence in the principles according to which the prosthetist conducts his practice, and the goodwill which is inevitable, will prompt high recommendation among friends, when skill, courteous treatment and satisfactory results are being discussed. The author is not now concerned with the question as to the justice involved in returning or retaining the fee, he is merely calling attention to the fact that men's minds—and women's too—are thus influenced in such a way that the practice of returning the fee to dissatisfied denture patients is very effective in increasing a desirable clientele.

**Psychological Value of Patient's Confidence.**—The patient's confidence that the prosthetist is fully qualified to supply satisfactory dentures, is indispensable if thorough cooperation is to be obtained. At the same time, this confidence may be found to be an undesirable trait and may easily result in the undoing of the prosthetist. Especially is this true, if it is not accompanied by, or permeated with, an intelligent appreciation of the results which properly may be expected. While in most professions and lines of vocation it may be said, almost without exception, that a satisfied patron is the best recommendation, this statement needs to be qualified, when the denture prosthetist is concerned. Between overconfidence and the patient's lack of confidence, the prosthetist will choose the latter.

**Dealing With Overconfidence.** Robust, ambitious, strong-willed, youthful, charming Miss Coquette has never worn dentures. She places herself in the prosthetist's care, has her teeth removed, and her mouth prepared as directed. She is easily supplied with dentures covering a large area; by diligent endeavor she masters the mysteries of mastication as well as the clicks of conversation. Her club associate, Mrs. Autumn, older in years, less vigorous in health, with superfluous face tissue, wearing her fourth set with peculiar lip control and exaggerated movement of the mandible, wants a set "like you made Miss C." "Oh yes," says the operator, "I recall her case very

distinctly; she had an excellent mouth for dentures, and I doubt whether I ever had another patient so ready and untiring in her efforts to become accustomed to them." With these or similar words, the prosthetist succeeds in impressing this patient with the idea, that she, herself, will be an important factor in securing dentures which she may wear with such satisfaction as her friend enjoys. This type of patient has all the confidence necessary; the prosthetist is safe in destroying a portion of it, while at the same time stressing the patient's responsibility for the success of the case.

**Confidence Inspired Through "Permanent" Dentures.**—The patient's confidence in the prosthetist's ability to give satisfaction in the wearing of dentures is increased, if the prosthetist has sufficient confidence in his own mastery of the situation to assure the patient that this is the last fee that will ever have to be paid for dentures. Of course, loss of dentures, or their destruction or injury through accident, is not covered in this assurance. The author is, in most instances, prepared to offer assurance that in the case of metal bases adapted to tissues which have apparently ceased to resorb there will be no other fee, because there will probably be no need of reconstruction, they will be "permanent" ones. In the case of "temporary" dentures, the patient understands that the tissues will probably change until the dentures must be replaced or reconstructed; he understands also that this will necessitate the payment of another fee.

**Methods of Inspiring Patient's Confidence in Himself.**—Previously in this work attention has been called to the fact that the patient's confidence in the prosthetist's ability is indispensable to the best results. The patient's confidence in himself is even more valuable. It is important to believe that the prosthetist will construct the best possible dentures; it is more important to believe in one's ability to wear whatever dentures are constructed. These two types of confidence are reciprocal in their effect; especially, when the patient's confidence in himself precedes stimulation of his confidence in the prosthetist.

**Occlusion Rests or Dentures Immediately Inserted.**—The insertion of occlusion rests or immediate dentures within thirty minutes or an hour after the teeth have been removed, contributes in a remarkable degree to the patient's confidence in his ability to wear dentures with satisfaction. Besides serving to give proper form to the blood-clot, and as a rest for the mandible, the satisfaction which the patient finds with these in his mouth compared to that with nothing to serve as rests or to hold out his cheeks and lips, imparts a readiness to tolerate

foreign objects of this size in his mouth, and thus renders him amenable to the further demands which dentures intended for masticatory purposes will make upon him. The author has yet to find an instance in his practice in which a patient thus provided with temporary bases has not worn dentures with readiness and comfort.

**Payment of the Fee in Full.**—Payment of the fee in full before the dentures are worn out of the office should be regularly required. From a financial standpoint there is nothing lost and from the psychological viewpoint there is everything to gain by this practice. It is probably the best possible method of encouraging the patient to lend the necessary cooperation to make the dentures satisfactory. Patients will wear their own dentures and make vigorous efforts to become accustomed to them, when they would have little interest in those belonging to someone else. If the fee has not been paid, the dentures belong to the prosthetist. While the patient does not often actually reason out the situation in this manner, he is unconsciously, or subconsciously, influenced unfavorably.

**Dealing With Patient Who Does Not Wish to Pay in Full Until Later.**—The psychological value of payment in full is so great that the author refuses to deviate from it, regardless of the financial rating of his patients, and regardless of the fact that in dealing with all others, they regularly send a check on the first of the month. If there is reason to believe that a patient may resent this method, because it may seem to be a reflection upon his integrity, the subject may be approached firmly and then followed up closely with: "It is a rule that I have always followed and I am sure that you would not wish me to make an exception in your case." And then, without waiting for a reply, the operator may turn to another phase of the case with some remark, such as, "Did any of your natural teeth overlap?"

**Clear Understanding Regarding Fee before Work is Begun.**—If the patient neglects to raise the question as to when payment of the fee must be made, the prosthetist should very frankly mention it, saying perhaps, "Now, wouldn't you like to know what these restorations are to cost, and the terms on which they are supplied?" The answer is always in the affirmative. Explanation is given and emphasis laid upon the requirement that half of the fee is to be paid when the impressions are taken and the remainder, when the dentures are inserted. (Please bear in mind, that "inserted" does not mean "completed," for the dentures may not be completed, so far as minor adjustments are concerned, for six weeks or, in some instances, three months.) If the patient has come ready to have the impressions taken,

and is not prepared to pay half of the fee at that time, the suggestion may be complied with at the next appointment. It is really an unimportant detail as to whether the fee is paid in two installments or whether the whole fee is paid when the dentures are inserted. The vital matter is that the dentures should belong to the patient when he begins to wear them. It may be observed, too, that insistence upon a rule of this kind strengthens the dentist's ability to secure the psychological aid in every case, which otherwise in many instances he may never secure. Also, a rule requiring two payments does not seem so exacting as a rule which insists upon the fee in one lump sum.

**Operator Retains Old Dentures.**—The patient's confidence in his ability to wear new dentures is encouraged, if the old dentures are kept by the operator. The new dentures must then, perforce, be worn and the more quickly will the tissues become adapted to them. "I usually keep the old dentures and I shall take it as a favor, if I may retain yours." If this is not successful, the dentist may secure permission to retain them for a week or several days. When the patient positively refuses to leave them, the author usually obtains a promise that the old dentures will not be worn without first securing consent. Assurance is given that if consent is requested, it will be given; and thus far in his experience, he has never been asked to grant permission, and he has never learned of an instance in which the promise was violated.

**Instructions in Use of Artificial Dentures Will Help Patient—Practical Suggestions.**—Some helpful practical suggestions often enable the patient to obtain relief from annoyances due to improper use of the dentures. Before the dentures were constructed the wise operator acquainted the patient with the fact that, for most people, artificial dentures are not superior to natural teeth. While artificial dentures have their limitations, these limitations may be reduced by a knowledge of the proper use of dentures. For example, a patient who has worn dentures, finds that his new dentures are not so close together as the old ones; consequently, when he brings them together during masticating movements, he is annoyed by the clicking sound that is made. He may be inclined to tolerate this, unless the operator advises him that this is wholly unnecessary and that he may learn to close them without any more noise than he experienced with the old ones. Again, a patient, who is otherwise perfectly satisfied with his dentures, is much provoked and embarrassed to find them easily displaced when he blows the sawdust away from his patterns. He may be taught a method of blowing which will not interfere in the least with retention

of his dentures. The technic of eating an apple or corn on the cob is different from that which characterized the use of one's natural teeth, but it may take the patient a long time to find out for himself that instead of biting and pulling the apple away from the teeth, he will get better results by pressing against the teeth while they are partly open, then closing upon the apple until a portion is cut off, after which the rest of the apple may be withdrawn.

**Persuading Patient to Tolerate Extended Palatal Portion.**—When a patient has gained the impression that his denture is too long and that this length is the cause of nausea, the operator often may find that the nausea is in large measure due to the patient's state of mind. A friend of the author's says that just as soon as he buys his steamship ticket he begins to feel seasick. And while the problem of seasickness has not been fully solved, this friend knows that it is influenced by mental conditions as well as by semicircular canals. Nausea, associated with the wearing of artificial dentures is produced in the vast majority of instances by a denture that very lightly touches the posterior portion of the palate. The author is accustomed to deal with these cases by inserting the finger and quickly and firmly rubbing this portion, saying at the same time, "It isn't because of the length of your denture. The trouble is that your denture isn't long enough." This is usually the fact: the base is not long enough, neither does it sufficiently compress the tissues in this region. When a fellow-bather playfully tickles the sole of one's foot as one reclines upon the beach, the sensation is unendurable but if he should boisterously apply a bastinado in Caliph of Bagdad fashion, the nerves of one's feet would not resent the stimulus nearly so much. If a patient returns to insist that the denture is too long, the author always and very willingly consents to trim away a portion and, if, in his judgment, it is required, a liberal amount is cut off. On the other hand, if he knows that the removal of any appreciable amount will be detrimental to retention, he makes good his willingness by using (in the presence of the patient, of course) a cuttle-fish disc in his fingers, and with vigorous motions proceeds to shorten the base to a supposedly very marked degree.

**Patients Should Feel Free to Return for Adjustments But Some Should Find It Inconvenient.**—When a patient has little patience and is inclined to return to the office with the slightest provocation, or without any real provocation at all, a period of meditation in the reception room while the operator is dismissing another patient from the chair, often develops patience—or at least lengthens the period of tolerance which the patient thought was already at a limit when he

came to the office. A somewhat longer period of meditation may be permitted upon the occasion of subsequent unnecessary visits. By "unnecessary," is meant that so far as physical or physiological conditions are concerned, the visit is not required. However, it should be borne in mind that psychologically considered, it is very necessary to encourage the patient to return for any aid that he seems to require. While the patient thinks that the aid required is physical or physiological, the operator knows that it is in many instances an aid to a change of attitude that is most needed. Appointments designed by the prosthetist to spoil a beauty-nap or make it impossible to attend the matinee, also help the patient to tolerate conditions which seem to her utterly intolerable.

Other patients, instead of imitating pampered children, resemble Spartans. They suffer severely and may be tortured by some irritating portion of the base, rather than "bother" the prosthetist. Sometimes it is necessary to call these patients and insist that they are not treating the dentist fairly when they do not give opportunity for adjustments which he knows usually must be made.

**Patient's Friends Should Confirm Selection and Arrangement.**—If dentures are properly constructed, the patient will be inspired by a knowledge of this fact to assume more readily the responsibility for successfully wearing them, than if he has doubts as to their construction. When some one doubts the appropriateness of the hue or the size or form of the teeth, or questions their arrangement, the patient will be strengthened in his conviction that the doubter's esthetic appreciation is poorly developed—if a friend or relative has previously said that the selection and arrangement are correct. This friend or relative should be present when the teeth are selected and set up in the occlusion models.

**Whatever Friend's Judgment, It Is Psychologically Valuable.**—As a student of art, or as gifted with superior esthetic appreciation such as would enable him to be a genuine consultant, the friend's judgment may possibly be rated low, and the prosthetist may have the double task of convincing patient and friend as to hue and mould best suited for the case, but psychologically, the assistance rendered may be estimated as immeasurably high.

**Securing Approval of Selection Made by Operator.**—The operator will be in position to confirm the appropriateness of the final result, if he is able to compare it with photographs of the patient's face and records as to the arrangement and hue and size and form of the natural teeth (the teeth themselves set up as they appeared before

removal constitute the best record). Both patient and "helper" may be helped to see the wisdom of a selection appropriate to the case, if the operator will select, for example, the whitest tooth of the hue guide; holding this tooth in position in the mouth, he may observe, and both of the others will usually be quick to agree, "This is much too light." Similarly, with the darkest one in position: "This is too dark." Then, selecting the tooth which he has seen is best suited for the case, he may hold it in position and find that both agree with his selection. Endorsement may be more easily secured, if it is possible to keep the rest of the hue guide from being brought into view.

**Friend's Assistance Significant While Dentures Are Being Worn.**—The real assistance, however great this may be when the teeth are being selected and arranged, will be rendered while the patient is wearing the dentures. Consciousness of the correctness of arrangement and appropriateness will be fortified by a knowledge that these were assured by a prosthetist of ability, by a friend, whose judgment is equal to that of any other friend's, and by such endorsement as the patient himself gave.

**Well-Being.**—An increasing sense of well-being is characteristic of our generation. Americans are proud of the fact that their standards of living and ideas of comfort are considerably higher than those of the Oriental. Nearly everyone seeks something more than the bare necessities of life; some covet an education and avail themselves of a broad culture, without expecting these to contribute aught else so much as a deeper enjoyment of life.

**Prosthetic Well-Being.**—Artificial dentures are not indispensable. Octogenarians have "gummed it" during the last quarter of their existence, and have not expressed dissatisfaction with life because of this lack. But most individuals today are unwilling to forego some kind of teeth; and in seeking substitutes for their natural ones, they are usually dependent upon the dentist for an appreciation of dentures which conform to standards to which they are accustomed in other phases of life. A patient who comes to a specialist, expects not only superior results, but usually must look to the specialist for an understanding as to what constitutes superior results. To acquaint patients with the possibilities of artificial dentures which they are justified in expecting, and then to fulfil their expectations, is the task of a prosthetic psychologist. In other words, in giving a patient a sense of prosthetic well-being the task of the prosthetist is largely one of applied psychology.

**This Sense of Well-Being Advanced Through Acquaintance with Continuous Gum Dentures.**—It will be found that this sense of well-being is readily communicated in the course of acquainting patients with the merits of platinum base porcelain gum dentures. It serves to give them an ideal. If they cannot well afford these, and if esthetic requirements do not demand their construction, patients nevertheless find themselves convinced that they are fully able to have gold or aluminum base dentures. Wherever at all possible, the author supplies his patients with metal base dentures. He is so thoroughly convinced of their superior merits that he would regard himself as guilty of a species of malpractice if he did not endeavor to supply his patients with these. In addition to giving to the patient and his friends and relatives an appreciation of the possibilities of prosthetic art, the presentation of the continuous gum denture is the occasion of such remarks by the patient and those with him, that the prosthetist may gather data which, more reliably than Dun or Bradstreet, will indicate to what extent this patient may become a patron of such art. Metal bases, besides contributing to a sense of well-being through giving the patient a satisfaction in possessing dentures of this type, and through enhancing his enjoyment of viands whose palatability to a large extent depends upon the temperature at which they are served, are superior to vulcanite in cleanliness and in freedom from injurious effects upon the tissues. However, the patient is perhaps most strongly influenced by the fact that metal is a good conductor of heat and cold and that a person wearing metal base dentures may more thoroughly enjoy such viands as tea, coffee, ice cream, etc.

**The Fee Compared with Yearly Expenses for Less Satisfying Comforts.**—When the patient has it brought to his attention in tactful manner, that dentures serve for years and that the fee paid for them if distributed as a cost item at so much per year, is small compared with yearly expense for wearing apparel or other personal comforts, there is little difficulty in enabling him to see that he can easily afford gold or aluminum base dentures. If the esthetic requirements demand, the patient usually can afford the continuous gum dentures. Just why so many dentists fail to supply their broadcloth and Rolls-Royce patients with anything but jeans or flivver quality in dentures, is difficult of explanation, except on the assumption that the dentists themselves are not sufficiently acquainted with the surpassing merits of dentures of the highest type to believe in them, and consequently lack a conscience which causes them to experience a sincere regret when it is necessary for any reason to supply anything of less merit.

**The Artist-Prosthetist Gives the Best Because He Seeks to Serve.**—Of course, there are members of the dental profession just as there are members of other professions, who experience regret only when it is associated with pecuniary loss, or with the possibilities of a reward that might have been greater in dollars and cents. Individuals of this type see nothing of beauty in a sunset at sea, experience no thrill in the presence of a heroic deed, and are left unmoved by the masterpieces of the great composers, painters, and sculptors of the world. For them dentistry is drudgery, its ideals are vagaries, and bread and butter are the only perquisites of life. To the artist-prosthetist, who rises to the level where he may live in the same realm with those whom he serves, Ruskin's sentiment makes a strong appeal:

"All works of quality must bear a price in proportion to the skill, time, expense and risk attending their invention and manufacture.

"Those things called dear are, when justly estimated, the cheapest. They are attended with much less profit to the artist than those things which everybody calls cheap. Beautiful forms and compositions are not made by chance, nor can they ever, in any material, be made at small expense."

**Patrons Pay for Skill.**—There need be no hesitancy in telling the patient that the materials for dentures cost no more than the portrait painter pays for a few feet of canvas and some brushes and tubes of paint. It is hardly necessary to suggest to him that both painter and prosthetist mix their paints and their porcelains with the most expensive media known to men—skill; and patient and patron have always been found who are ready to pay for skill.

**Prosthetist's Service Compared to that of Portrait Painter.**—What is it worth to possess efficient masticatory substitutes which may be worn with such comfort that the wearer forgets that they are not physiologically a part of himself—dentures which, often enough have been demonstrated before State and National Societies as constructed with such skill that they absolutely defy detection as artificial, even within the closest conversational range? Who will dare to say that the restoration of facial beauty, together with a gratifying masticatory mechanism, the relieving of embarrassment, increasing of self-confidence and filling the whole prospect of life with delight, is not deserving of even greater regard than the artist's achievement of a portrait, whose charm may lack nothing but the breath of life?

**Psychological Improprieties in Impression Taking.**—Just as it is wise to employ gum tragacanth to avoid displacement of the

occlusion models during the process of securing central occlusion, because it is not wise to arouse any unwarranted fears, in like manner it is wise to avoid the encouragement of all thought or movement which may militate against retention of the dentures. While it is readily admitted that the operator who is an expert in the use of modeling compound may take impressions as perfect as those taken by the plaster enthusiast, in most instances the worker with compound is guilty of teaching the patient some movements which are decidedly detrimental, in a psychological way, to ultimate success in retaining the denture. The patient should be encouraged in every legitimate way possible to endeavor to retain the denture; instead, operators have in times past taught the patient to endeavor by seven different muscular displacing activities, namely, by whistling, sneezing, coughing, hacking, yawning, spitting, grinning, to displace the impression. The patient is thus taught, whether the operator so intends it or not, that the finished denture will withstand similar efforts and be retained in spite of them. In the first place, the patient is led to believe that the impression is an unusually good one; the fact is that any impression, if it produces a vacuum chamber, will be retained just as effectively. In a very poor impression, it may happen that, when the compound is pressed to position, an abnormally large vacuum chamber may be produced. If it be assumed that such an impression is perfectly reproduced in the finished denture, and that the vacuum produced by the impression may be produced by the finished denture, the tissues will change under the pulling effect of the vacuum. After this, the denture may be easily displaced, without any review of the lessons in displacement which the dentist taught while the impressions were being taken.

**Patient Should Never Be Challenged to Dislodge Impression or Denture.**—Not infrequently, the dentist is deceived into thinking that his impression is a splendid one, but no impression is perfect enough to justify the contest which he unwittingly enters. He challenges the patient to dislodge it. The patient does not know that the contest has ended with the impression taking. He continues his efforts with the denture and at the end of a few days emerges victorious, and returns to the office with an "I-told-you-so" expression on his face, and perhaps later returns too frequently with the dentures in his hands.

**Underconfidence Better than Overconfidence.**—The author has found it wise in dealing with patients who have previously worn dentures without satisfaction, to remark, when the impressions tend to be displaced

with difficulty, "Wouldn't it be gratifying if I could assure you that your new dentures will stick like that? They won't, because they will be made of different material and the abnormal condition, which now prevails, will not always exist."

**Patient's Ability to Use Dentures Should Be Challenged.**—Dr. I. Lester Furnas of Cleveland, Ohio, emphasizes the fact that a tacit challenge may be conveyed to the patient through the suggestion that no effort need be made to masticate with artificial dentures until the patient has become thoroughly accustomed to their presence in the mouth. The probabilities are that the patient will take delight in showing the prosthetist that the period allowed for becoming accustomed to the presence of the dentures has very largely been occupied with using them in mastication.

**Problem of Securing Central Occlusion Is Psychologically Considered.**—The prosthetist seeks, in securing central occlusion, nothing more than a record of the "central occlusion relationship" of the patient's jaws, a relationship which the patient establishes a thousand times a day when he may be miles from a dental chair. The photographer, who takes sittings of children in their own homes, gets some splendid life-like results. If the prosthetist could evolve a method of registering central occlusion with the patient at home in the use of his jaws, while eating a meal, perhaps, he would more easily achieve the result which he seeks. Just as the expression on a child's face shows that it is difficult for him to be natural in the midst of the strange surroundings of a photographer's studio, so do the efforts to secure central occlusion show how difficult it is for a patient to be natural in masticatory movements, in the midst of the usual directions and paraphernalia employed. Psychologically, photographer and prosthetist have the same problem; each employs his own peculiar methods in solving it. Neither is able to get the result he seeks simply by requesting the patron or patient to give it. The old-fashioned studio exhortation, "Now, look pleasant, please," yielded some curious specimens for our mother's album. "Close naturally, please," or "we are now going to get your natural bite," are types of appeal which are even more futile in the prosthetist's attempt to get the desired reaction. The photographer with his antiquated method will be more likely to get a desirable response than the prosthetist who employs the expressions just mentioned. Nearly everybody has an idea as to how he looks when he is looking pleasant, but how many have the slightest intimation of a "natural bite"!

**The More Nearly Attention Is Diverted from "Method" of Performing an Act, the More Nearly Habitual It Will Be.**—As a rule, the more completely a person's attention is diverted from his method of executing an habitual movement, the more nearly will a normal or natural movement result. An habitual movement is one which ordinarily does not require the attention of consciousness in order to secure its performance. The closing movement desired in securing central occlusion is but one of the series of movements necessary to mastication. Similar to other habits, it is difficult to select a single act of the series and concentrate upon the method of performing it; in fact, the effort to separate an act from the series in the midst of which it usually occurs, is often not only confusing but utterly unavailing. This is true of some of the most simple habits; for example, in dressing, do you don your coat by first inserting the right arm and then the left, or vice versa? In jumping, do you "take off" from your right foot or your left? In starting your follow-through stroke, are your elbows above the plane of your hips or below? In alighting from a moving train on the left side, does your left or right foot first touch the pavement? Is the same answer true when you alight from the right side? How much greater confusion of mind, to say nothing of embarrassment in execution, is aroused by the request to "close naturally!" And the confusion and embarrassment will not be lessened by the patient's knowledge that successful dentures depend upon doing it correctly.

**The Prosthetist Should Register Central Occlusion While the Patient Closes in His Accustomed Manner.**—Instead of asking a singer to sing a particular note of a melody, we will do better to ask that the melody be sung, so that we may give our attention to this one note; rather than ask the instrumentalist which finger he uses in beginning the cadenza or playing the difficult arpeggio, let us ask that the selection be played, and while it is being played, we may watch the fingering for ourselves. In both instances we shall obtain a more satisfactory reply than if we insist upon the singer's or player's unnatural, or nonhabitual concentration upon a unit of the series. Likewise, if the prosthetist can take his central occlusion from a series of closing movements made by the patient, he will secure an habitual relationship of upper and lower jaws which, incorporated in the artificial dentures, will be found to be correct.

**No Word Such as "Bite" Should Be Used.**—Accordingly, during the process of recording central occlusion, no mention of "bite" should be made, because this word will convey to the patient a sug-

gestion in keeping with his past reactions upon meeting with this word. "Bite" instinctively prompts a protrusion of the lower jaw, as in the act of biting an apple, just as "gnaw" prompts him to get ready to use his "canines," or as "nibble" suggests a mincing use of the centrals and laterals, or as "chew" suggests exercising the molars.

**Every Movement Encouraged.**—Suppose the bases in position for the closing movement. Let the operator casually remark, "I wonder whether you can close your mouth with your new wax teeth." And as the remark is finished, the operator closes his jaws with a snap into correct central occlusion. The patient following the suggestion, tries but, instead of bringing them together as the dentist desires, thrusts his jaw forward to one side. Let the dentist say, "Fine. Now see whether you can do that again." This time the jaw lunges to the other side. "Good, you don't have any difficulty at all," and with a few other remarks of encouragement, the dentist continues to invite the closing movements until the patient brings the bases into correct apposition.

In fact, from the psychologist's viewpoint, every movement made by the patient is correct, in that the chief object is to secure a series of movements in the midst of which may be obtained the one which the prosthetist desires to record. Nothing should be said or done that will lead the patient to think that any movement of the jaw is not exactly as the operator wishes it. Every movement is correct; every relationship of the jaws is correct. By this is meant that there should not be aroused in the patient an anxiety about closing just right, since such concentration may defeat its accomplishment. If the patient were not *making an un-habitual* effort to perform the *correct* or *habitual* closing movement, he would respond almost instinctively with the correct movement, immediately upon getting a sensation from the touching of the posterior portions of the two occlusion rims.

**Impatience of Operator Discounts His Understanding of What Is Required.**—The author recalls instances in which excellent operators have encouraged patients to swallow, to bend head backward, have applied pressure to the patient's chin, have shown by retrusive movements of their own jaws the kind of movement desired. All of these methods seem to be contraindicated. Exhibition on the part of the operator, of impatience, peevishness, disgust or disapproval, because of the patient's failure to close correctly, delays the result, and is *prima facie* evidence that the dentist does not realize that to secure

central occlusion involves something more than a physical or physiological procedure.

**Proper Preparation of Materials Largely Solves Problem of Psychology.**—While emphasis has been laid upon the fact that the problem of securing central occlusion is largely psychological, it is influenced very largely by material factors which are almost wholly within the prosthetist's control. Consequently, the psychological problem is in large measure solved, when the prosthetist has made careful preparations in anticipation of the final movement of the procedure. Quite obviously, the material factors which will be most vital in this procedure are the occlusal rims. These should be constructed with much care, and the finish and polish should be comparable, so far as the material permits, to that of the finished dentures.

**Gum Tragacanth Avoids Arousing Patient's Fears.**—The patient's mind will be free from anxiety which may be aroused through the tendency of the bases to be displaced, if the operator will take the precaution to sprinkle them lightly with powdered gum tragacanth or a similar preparation. Not only will this contribute to success at this stage, but the patient will not fear that in all probability the finished dentures will have a tendency to be displaced. Nothing occurs to suggest it.

**Textbooks Cannot Provide Application of Psychology Such as Daily Experience Affords.**—The study of textbooks in psychology, and the reading of treatises on mental processes and the workings of the human mind will contribute much to the prosthetist's ability to secure cooperation from those whom he serves. He will learn to classify individuals according to certain well-defined traits of character; he may learn that certain classes or types, because of these traits, may be approached in certain definite ways; but as a practitioner, he will learn that no individual belongs to any one of these classes or types—that each individual constitutes a class of his own. On this account, the application of the prosthetist's knowledge of mental processes in general to the particular problem of an individual will be a test of skill, and may properly take rank as an art. This cannot be learned from any other sources so well as from experience. The inspiration to its mastery will come with a sincere effort of the prosthetist to fulfil his obligation as a vital member of society through continually rendering the best service of which he is capable, welcoming every patient as an opportunity to do unto others as he would that they should do unto him.

**Psychology Is No Substitute for Conscientious Endeavor.**—While the contribution to successful prosthetic practice, which the proper use of psychology may make, cannot be too strongly emphasized, neither can the fact be sufficiently emphasized that no psychological aid is legitimate in an endeavor to excuse an operator from any responsibility in constructing or reconstructing a denture so that it may approach as nearly as possible 100 per cent, measured by the operator's ability.

## CHAPTER III

## MOUTH EXAMINATION AND PROGNOSIS

**Method of Impression-Taking Largely Supplies Need of Other Examination of Mouth.**—The need of a charted oral cavity may be largely obviated through the employment of a method of impression-taking which may be said to provide almost automatically for varying mouth conditions. Some operators find it necessary on account of the method which they intend to follow in taking impressions, first of all to make a thorough-going digital as well as visual examination of the patient's mouth and then to modify their method accordingly. Some have found that a classification of mouths is helpful in securing results.

**Materials Used Contribute Largely to Successful Results.** Provisions in a very high degree are made for the varying conditions found in different mouths through the employment of: black tray compound in the construction of an individual impression tray (which is the most important single factor in securing an accurate impression); Kerr's compound in determining the proper height of the borders, in preventing encroachment upon tissue attachments and in providing against interference with lingual muscles; carding wax in post-damming and in peripheral adaptation; together with the use of plaster, which, in securing the final impression of the tissues, does not subject them to unnecessary pressure. Exceptional cases will disclose themselves as the suggested technic is followed and exceptional treatment may then be accorded.

**Examination to Determine Size of Metal Tray Required.**—With the method of impression-taking employed by the author, he finds that the examination most needed in the majority of cases is that which is necessary to ascertain the size of metal tray required in making an individual tray with the use of compound.

The following facts will be disclosed in the course of practice:

1. **Area.**—All other conditions being practically the same, the mouth with the largest area to be covered with the base of the denture will have the best retention. This is in keeping with the laws of adhesion and of atmospheric pressure. See chapter entitled, "Physical Factors Important to Full Denture Prosthesis."

2. **Tissues Overlying Bony Substructure.**—If the tissues overlying the bony substructure are of a firm resilient character, they will provide a cushion in which the base of the denture may slightly imbed itself and thus provide a seal against the ingress of air. The more perfect this seal is, the more fully operative will be the law of atmospheric pressure. If the seal is broken, atmospheric pressure becomes inoperative. As long as the denture is closely adapted, atmospheric pressure is a potential force only. When leverage tends to loosen the denture, a slight vacuum is created and with resilient tissue this vacuum may be increased without losing the seal around the borders; then it is that atmospheric pressure is tremendously effective in retaining the denture. Further, this cushion of resilient tissue enables the patient to exert extreme masticatory power against the bony substructure without injury or pain which might be caused if this membranous tissue were hard and tense. If hard and tense and thin, the pain caused by impingement upon the nerve endings may make it impossible for the patient to masticate his food with comfort. This impingement may frequently manifest itself, not in the direct consciousness of pain accompanying every masticatory effort, but in a kind of subconscious uneasiness and fear of severe pain which keeps the patient from really attempting any genuine masticatory effort.

3. **Irregular Surface of Bony Substructure.**—The mouth covered with thin tense tissue and the difficulties resulting from such are not to be confused with another condition of mouth structure which is also responsible for pain and fear of pain. Irregular surface of the bony substructure with loose particles of bone or spicula beneath the mucosa is similarly productive of discomfort, when the force of mastication is exerted. A minor surgical operation will usually correct the latter, while the former presents a much more difficult problem. When there are pronounced under-cuts on the lingual as well as on the buccal or labial aspect of the ridge, and these are opposite each other, they should be referred to the oral surgeon.

4. **Tonus of Tissues.**—While it is important that the mucosa of the ridges should be of sufficient depth to provide a somewhat yielding support for the base of the denture, it is also important that this tissue shall be healthy and properly served with nerve and blood supply. Otherwise, an anemic tissue fails to adapt itself to the denture and lifelessly tolerates its presence instead of responding in some kind of "clinging" fashion to prevent its displacement under stress.

5. **Height of Ridges.**—A comparatively high ridge has the advantage of making the denture more secure against lateral stress. A comparatively flat ridge usually has a broader base and such a base gives more area for contact and consequently increases the retention that is provided by adhesion and atmospheric pressure. In view of these facts, the prosthetist regards the flat ridge not unfavorably and may even prefer to construct dentures for this kind, inasmuch as the prevention of lateral movement is of far less importance than the retention of the denture under other conditions.

6. **Frenal Attachments.**—If the labial and buccal frena attach the lips and cheeks high up on the mucosa of the maxilla, they will not interfere with the peripheral border of the denture when it is extended here, as is often the case when they are lower. Even when comparatively low, the frena, if thin, may easily be provided for in impression-taking in such manner that a valve seal may be maintained around them.

If the frena are low and broad, the surest method of providing against their interference is by a minor operation. A triangular-shaped portion of the frenum is removed—the base of the triangle reaching from the origin of the frenum on the ridge to its attachment on the lip or cheek, the apex of the triangle indicating the depth to which it is necessary to cut in order to loosen the lip or cheek until it is as free here as elsewhere along the ridge. (See p. 180.)

In performing this operation, the operator will anesthetize the part according to his favorite method and then cut out the portion with a pair of scissors. Unless the denture is to be inserted immediately, the frenum should be sutured at the point from which the apex was cut, otherwise new tissue will replace this which was cut out, and the operation thus be rendered futile.

7. **The Tongue and Its Attachments.**—Where the attachments of the tongue below the mylohyoid ridge are low, and if the denture is not easily displaced when the tongue is protruded, the area may be extended to provide additional retention of a mechanical type. This extension, which is really a flange of the base of the denture, is possible in rare instances only. Whenever the attachments are high, the impression must avoid encroachment upon them.

Patients who have long been edentulous have large tongues, and greater difficulty is experienced by these patients in retaining mandibular dentures. The mistake should not be made in these cases of concaving the lingual surface of the denture, since this provides an additional fulcrum for the tongue in its denture-displacing movements.

8. **Relationship of Arches.**—Sometimes the relationship of the mandible to the maxilla is such that a typical arrangement of teeth will not give desirable results. In the case of orthognathous or prognathous patients, a surgical operation may improve the relationship, and the prosthetist may further improve it by his arrangement of the teeth. Usually an attempt to correct the condition will be more successful if a moderate improvement is decided upon instead of a complete correction. The employment of additional teeth or the omission of one or more often serves with splendid effect.

9. **Saliva.**—Thin water-like saliva is favorable to the retention of artificial dentures; it perfects the contact of denture with tissue and contributes in this manner to retention by adhesion. Thick, viscid or ropy saliva prevents evenness in contact and its presence consequently is not desirable. Where thick saliva is present, the mouth should be washed out before the impression is taken. For this purpose a glass of water containing a few drops of hydrochloric acid (three drops to eight ounces of water) serves very well. The patient should rinse the mouth successively until the whole amount has been used. Alum water is also recommended. Mouth washes containing zinc chloride are likewise indicated. When the patient begins to wear dentures, the same agents may be employed as often as necessary. However, the presence of dentures will stimulate the flow of saliva and often render other helps unnecessary.

10. **The Raphe.**—The raphe is the hard bony process of the median line constituted by the junction of the palatal bones. It often becomes, in its posterior portion, enlarged and prominent until an attempt to relieve the denture at this point results in an ingress of air to the detriment of retention. In instances of this kind it should be surgically removed. The hard raphe is characteristic of the vast majority of mouths and its presence, necessitating construction of the base of the denture in such manner as to relieve the pressure of the base against it, is so universal that the writer makes it a practice to relieve, slightly at least, all bases.

11. **Rugae.**—In the V-shaped high vault type of mouth, the rugae are more pronounced than in broad "flat" mouths. After the impression is taken, it is often wise to deepen the impressions of the rugae. A small vulcanite scraper is used for this purpose.

12. **Junction of Hard and Soft Portions of the Palate.**—In many instances the junction of the hard and soft portions of the palate follows a line that is almost direct from tuberosity to tuberosity, but

in others it follows the symmetrical curves of the extreme posterior portion of the palatal bones.

Mouths in which the soft portion of the palate drops down almost perpendicularly from the posterior border of the palatal bones provide a smaller area for compression and consequently the line of post-damming will be narrower, and on that account the degree of compression must be slightly greater. This type requires a denture with well-rounded thick posterior border.

Mouths in which the soft portion of the palate does not drop so abruptly, tolerate an extension of the base over a larger area posteriorwise and rarely need to be post-dammed.

13. **Other Factors Contributing to Prognosis.**—While a knowledge of the conditions referred to in the foregoing portion of this chapter will in any given case enable the prosthetist to construct a denture successfully so far as actual physical and physiological conditions are concerned, a few other items of information will the better prepare him to deal with the patient.

The ultimate outcome of his efforts will be vitally affected by:

A. **Lapse of Time Since Teeth Were Removed.**—Patients who may be provided with artificial dentures within an hour or two after their teeth have been removed are to be congratulated. These patients have not had time to develop habits which are unfavorable to the wearing of dentures, the ridges are conformed to become more suitable for bases, and they have begun almost immediately to grow accustomed to wearing dentures. (See Chapter on "Immediate Denture Service.")

Patients who have gone without dentures for several months after their teeth have been removed, find that their lips and cheeks are sunken, and that the restoration of contour adds to the task of securing satisfactory dentures. The normal distance between mandible and maxilla has decreased and it is more difficult to become accustomed to dentures restoring the original distance. The tongue grows thick and occupies space which it is desirable the mandibular denture should occupy; enunciation is impaired; no well-defined movements of the mandible are established and the presence in the mouth of such large foreign bodies as dentures is difficult to tolerate.

B. **Age of Patient.**—The age of the patient, if under fifty years, will contribute to final success. At or before this age ambition is usually still active, habits are not irrevocably fixed, and the tissues are more vigorous and capable of adapting themselves to the artificial dentures. The patient is still able to exercise a voluntary mus-

cular control which may perhaps be impossible to one who has reached the age of senility.

The age suggested, although this may vary, usually finds a patient desirous of having well-fitting and natural appearing dentures. Later in life, he may decide to get dentures because of the insistence of some member or members of the family. Those of this last mentioned type will find it difficult to cooperate with the prosthetist in making the outcome satisfactory.

When the patient finds that his dentures are well adapted during the morning hours but gradually become loose as he becomes weary during the afternoon, the operator may sometimes find it advisable to construct new dentures from impressions taken late in the day.

C. **Convalescing or Declining Health.**—If a patient is convalescing or his health improving all the while, his tissues will be more responsive to the demands which the wearing of artificial dentures makes upon them. On the other hand, a patient whose health is failing will have tissues receding from a good tonicity, and dentures originally well adapted will gradually become poorly adapted. Responsibility for the progress of a patient's health is often shifted to the prosthetist by a physician who says, "Go to your dentist and get some teeth so that you can chew your food; then you will get some strength from what you eat." Artificial teeth are not the only alternative. Food-choppers and colanders are available. People have lived to be centenarians and during the last few decades of their lives have been without teeth of any kind. Sustaining foods with full quota of vitamines may be found which require little if any mastication.

Patients in declining health should be instructed that they may find it helpful to bridge over the period until their health begins to improve, if they will employ an adhesive preparation to assist in retaining their dentures.

D. **Melancholia.**—A patient suffering from melancholia sees life from a dejected viewpoint. Life is all against him—this includes artificial dentures. Dentures, for him, are merely others of the evils of life, and the patient's depressed state of mind deprives him of the effort required to become accustomed to wearing them. The optimistic patient has an encouraging and expectant attitude toward life in general and expects to grow accustomed to wearing dentures—and does.

E. **Retaining the Old Dentures.** If the patient has previously worn dentures, the prosthetist should keep these if possible. This removes

the temptation to wear them instead of becoming accustomed to the new ones. The patient may object to leaving them, but if he can be persuaded to do this for a few days, the victory is usually won. Then they may be returned. If persuasion is unavailing, then the prosthetist may often gain the desired delay by exacting a promise that the old dentures will not be worn without first asking permission of the prosthetist, which the prosthetist agrees to give, if asked. To call over the phone requires effort, implies to a degree a confession of weakness in perseverance or will, and consequently permission is seldom asked—nor are the old dentures worn.

F. **Fee in Full as an Aid to Complete Success.**—The prosthetist should receive his fee in full when the dentures are inserted. In no other phase of dentistry, and in few other phases of professional or business life, is it so imperative that the person served shall pay in full, in order that the service which he receives may benefit him as it cannot otherwise.

# CHAPTER IV

## IMMEDIATE DENTURE SERVICE

**Surgical Removal of Teeth Is Most Satisfactory.**—"You may pull teeth; you may extract teeth; or you may remove them by a surgical operation." Undoubtedly, this statement expresses the relative importance accorded the subject of extraction by the dentists of our country. Without intending any disparagement, it may be said that the general practitioner pulls teeth, the specialist extracts them, while the oral surgeon surgically removes them. While this may be true as a rule, it is entirely possible for both general practitioner and specialist, as well as the oral surgeon, to remove teeth surgically. However, the author has the first mouth yet to examine from which teeth and sufficient process have been properly removed by either of the first two procedures named, unless specific directions previously have been given in order to secure the results desired by the prosthetist.

**Immediate Denture Service Rarely Satisfactory without Surgical Operation.**—If dentures are desired immediately, satisfaction with the results is rarely possible without the removal of the teeth by means of a surgical operation. When the prosthetist is not also an oral surgeon, he should be able to refer his patients to an oral surgeon who is in accord with his views of what constitutes a proper removal of the teeth and a suitable preparation of the mouth.

**An Impression in Which the Teeth May Be Placed after Removal.**—Whenever at all possible, the prosthetist should obtain an impression of the natural teeth before they are removed. In order to facilitate the replacing of the teeth after removal, the technic of modeling compound impression-taking is here varied to the following extent: the compound (Kerr's modeling compound) is placed in a suitable tray and allowed to chill until, under most circumstances, it would be too cold for impression-taking. At this juncture the entire surface is coated with white vaseline or cocoa butter and the entire surface of the compound superheated over a flame for a second or two only. This is placed in the mouth and pressed up until the greatest bucco-lingual diameter of the teeth is reached, when the impression is held until chilled. The tray of compound is now easily removed and there is no dragging of the compound, not to mention especially the ease

with which the teeth may be replaced in the impression—a process that is very trying with the usual "good" modeling compound or plaster impression. After the teeth are cleaned and dried, the teeth are placed in proper position and sufficient wax is added to hold them firmly. When all of the teeth are in position, the case will appear something like that shown in Fig. 116. The case is poured with plaster of Paris, and the compound then removed from around the

Fig. 116.—Teeth in compound impression ready to be poured with plaster to serve as study cast.

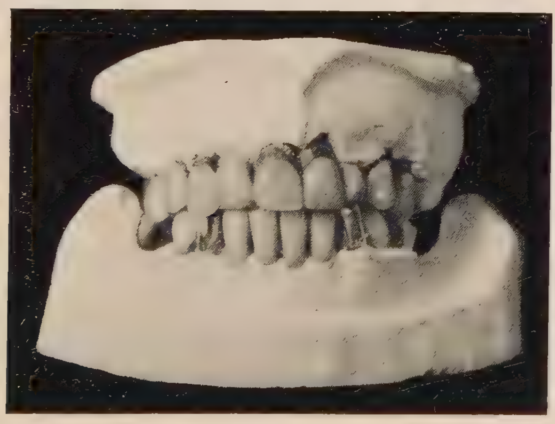


Fig. 117.—Patient's natural teeth in study casts.

teeth. The teeth thus set in plaster should be preserved for study purposes (Fig. 117); of course, the plaster will be cut away from around the teeth until it resembles as nearly as possible the original gum tissue.

**A Second Impression Is Taken, To Be Used When Making a Guide for the Surgeon.**—When dentures are to be inserted immediately fol-

lowing the surgical operation, it will be imperative to take another impression. The cast poured of plaster in this second impression will later be trimmed in order to approximate the cast which might be obtained of this patient's mouth immediately after the teeth are removed. To trim the cast in this fashion may at first seem like inviting a man to do the impossible, but the procedure is not difficult. The cast is trimmed by cutting away the teeth and the excess labial and buccal surfaces just as the oral surgeon will prepare the mouth usually by a removal of the teeth and portions of the labial and buccal plates of the ridges.

**Securing Cooperation of the Surgeon.**—When the dentist is both a prosthetist and an oral surgeon, he will be able satisfactorily to determine the desired results. If he must depend upon the oral surgeon to prepare the mouth, he will wisely furnish the surgeon with a guide, according to which the mouth may often be prepared with the requirements of the prosthetist in mind. Occasionally, of course, pathological conditions will make it impossible for the surgeon to regard the case with a view to cooperating fully with the prosthetist.

**This Impression Should Be an Impression of Tissues Rather than of Teeth.**—The operator, in preparing to take an impression which shall serve in making a guide for the oral surgeon, should select an oversize metal tray. S. S. White's Impression Tray Compound is warmed until it may be formed into a cone, which is placed upon the tray and roughly conformed to the outline of the vault of the mouth. The surface of the compound is oiled with vaseline or cocoa butter, then superheated in the open flame, and pressed into place in the vault. It is essential that the impression shall be an impression of the vault of the mouth, recording in particular the junction of the hard and soft portions of the palate, and also the gingival tissue surrounding the teeth. The tissues at the junction of the hard and soft portions of the palate must be compressed, if the finished denture is to be properly adapted and sealed against the ingress of air—just as an operator is accustomed to compress them in post-damming an impression of an edentulous mouth. The operator should keep in mind that he is not primarily interested in an impression of the *teeth,* but in an impression of the contiguous tissues.

After the cone-shaped mass of S. S. White's tray compound has been pressed up to place in the vault of the mouth, it is removed from the metal tray and any portion over the buccal or labial surfaces of the teeth cut away.

**Black Carding Wax Is Used in Post-damming.**—Black carding wax is used to assist in compressing the tissues as desired. A roll of black carding wax about the size of a lead pencil and just warm enough to be pliable—in the summer months the warmth imparted by the hands during the process of forming the roll is sufficient—is laid across the posterior portion of the tray upon the compound and sealed to it. This is then pressed firmly to position.

**Buccal and Labial Portions Taken with Plaster.**—When the impression has thus been post-dammed to the operator's satisfaction, it is returned to the mouth and completed along the buccal and labial regions by means of plaster. Plaster is used in securing the impression in these regions because the plaster is more easily manipulated, and because this material will yield an impression of the tissues in their rest position, which is to say, the lips and cheeks will not be distended. When the impression is returned to the mouth after post-damming, the operator holds it in position with the index finger of one hand while he manipulates the plaster with the other. If the patient has a sufficient quota of teeth remaining to enable him to close securely upon the impression, he may assist the operator by so doing. The plaster is mixed as in taking a plaster impression for an edentulous patient, except that a smaller amount of potassium sulphate is used as an accelerator. This amount of accelerator required is less because the operator requires time enough to permit him to place plaster along both buccal and labial borders of the maxilla before the plaster begins to harden. With the tray compound impression held firmly in position as suggested, the plaster is placed along the ridge as far back as a point corresponding to a position just posterior to the last molar. A spatula or the index finger may be used in placing the plaster. Each side is supplied with plaster and the two sides are brought forward and joined in the median line. The cheek and lips are now massaged gently downward; this serves to remove excess plaster and to record a definite and proper height for the periphery of the finished denture, and to mark the position and assure freedom of movement for both the buccal and the labial frenum.

**Plaster Is Removed in Sections.**—When the plaster has hardened until there is no danger of crumbling, a V-shaped section in the median line is cut through the plaster. The knife is then used to pry off first one side and then the other. Rarely, the plaster may be removed in a single section on each side, but usually each side is removed in two or more sections; these sections are laid upon blotting

paper for an hour or more to dry (Fig. 118), when they may be easily assembled with the palatal portion of the impression (Fig. 119). After assembling, the sections may be held together by means of sticky wax. The impression is now coated with shellac and after this has dried, a coating of sandarac is applied. (Instead of either shellac or sandarac any separating medium which the operator has found preferable, may be employed.)

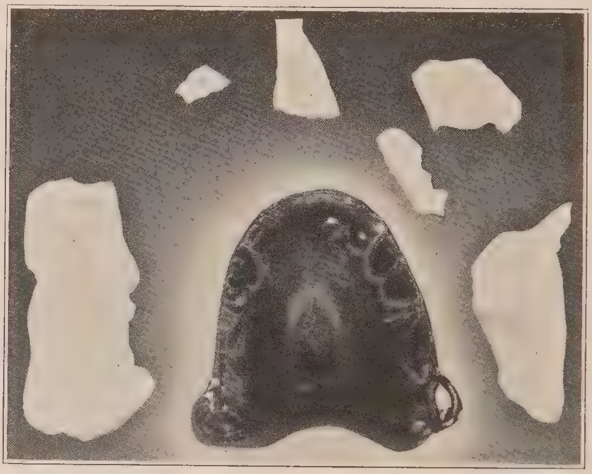


Fig. 118.—Impression of buccal and labial regions is taken in plaster and removed in pieces.

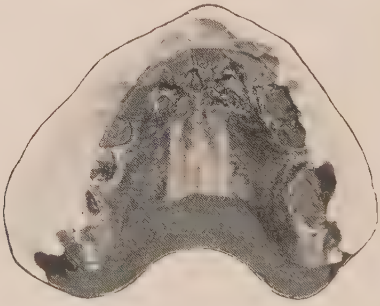


Fig. 119.—The pieces are easily assembled after drying.

**Impression is Poured.**—When the sandarac is dry, the impression is poured with Austin's synthetic stone. In order to determine whether the sandarac is dried sufficiently, the operator may hold it against his cheek. If it seems sticky, it must be allowed to dry for a longer period; if placed in front of a fan, either sandarac or shellac will dry more quickly than in any other way.

**Technic of Pouring.**—In pouring the impression, the operator places a spatula load of the mixture upon the vault of the impression and holding the impression he jars his hand down upon the bench; this repeated jarring drives the material down over the palatal surface into the individual tooth impressions, entering on one side, then down to the bottom and up the other side completely expelling the air, thus avoiding bubbles in the cast. More material is piled up and jarred down until the impression is filled and a bulk not more than a centimeter in depth is left over the entire surface to serve as a base for the finished cast. The impression thus supplied with synthetic stone is inverted upon the bench and allowed to harden. The object in making this base of the cast not more than a centimeter thick is to avoid the inconvenience which a greater thickness will be liable to cause in mounting upon the articulator or in flasking.

**Taking Mandibular Impressions.**—In taking the mandibular impression, a metal tray of proper size is employed. The buccal and labial flanges are often cut away, when the bicuspids and molars remain. The lingual flange is retained. Often it is necessary to trim the lingual flange to keep it from impinging upon the lingual attachments. A wire strengthener (Fig. 12) is employed. S. S. White's tray compound is placed along the base of the tray and lying against the lingual flange. The compound should be warmer than that employed for the maxillary so that the patient's protruding tongue may displace any excess material. The warm compound is moulded to approximate requirements of the mandibular teeth. If teeth are missing, a greater bulk of compound will be required in the corresponding position on the tray. The surface of the compound is oiled and this surface superheated as in the case of the maxillary impression; when inserted and carried to the posterior portion of the mouth and then brought forward and downward with a firm pressure, the patient is requested to protrude the tongue. The tongue remains in this protruded position until the compound is slightly cooled, after which, with the saliva ejector in place, a stream of cold water may be thrown against the black tray compound and thus further chilled. The practice of protruding the tongue tends to prevent the compound from encroaching upon the lingual tissues. Any excess that is forced down upon the buccal surfaces of the teeth should be pressed back over the edge of the tray before the compound is chilled.

**Avoiding Difficult Removal Caused by Undercuts.**—The impression is removed and all excess compound is cut away until the impression

will easily go to position when returned to the mouth. It may be suggested that in the case of irregular alignment of the teeth which may hinder a free withdrawal of the impression from the mouth, the case should be removed shortly after it is pressed to position, and that portion of the compound which forms the undercuts cut away freely. It should be kept in mind, as previously suggested, that the operator is not primarily interested in impressions of the teeth themselves but rather of the contiguous tissues.

**Correcting the Impression.**—In taking the mandibular impression, if the compound on the lingual portion seems to encroach upon the tissues, this particular portion of compound should be rewarmed and the case returned to the mouth to be trimmed again by another protrusion of the tongue. This should be repeated until the encroachment no longer occurs.

**Proper Massaging Perfects the Impression.**—Plaster is now mixed in the same way as for the maxillary and with the tray compound impression pressed to position, the plaster is placed upon the buccal and labial surfaces of the teeth. While the plaster is put into position with one hand, and this hand used later to bring the lips and cheeks to a position of rest, the tray is held firmly in place with the other hand. In holding the tray, the thumb rests upon it while the fingers of this hand grasp the lower part of the mandible. In reducing the bulk of plaster so that the lips and cheeks may assume a normal position, that is, without being unduly pressed or strained or distended, the fingers and thumb of one hand are employed to massage the lips and cheeks. This process requires that the fingers be pressed and moved against the lips and cheeks in the direction of the occlusal plane. To massage thus in this direction assures an impression the height of which is sufficient to include all of the tissues available to secure retention of the completed denture. Such massaging will, of course, prevent a bulk of plaster from distending the cheeks or lips near the peripheral border and consequently assures that the bulk of denture at this point will not be too great. The distending of cheek or lip must be avoided. Any thickness of the buccal or labial border of the finished denture will be that much more of foreign material between ridge and cheek or lips than the patient has had while in possession of his natural teeth. Therefore, this border should be no thicker than necessary to give the strength required.

The importance of properly massaging the lips and cheeks in order to assure proper height of the finished denture has been stressed be-

cause to some readers it may not be clear that the border of this impression will in no wise differ from the border of the impression that might be taken after the teeth are removed. The impression of the ridge only will differ.

**Character of Ridge Is Determined by Operator.**—The operator employing this method is enabled to determine what the character of the ridges shall be after the teeth are removed. The ridge will become smooth and without pronounced undulations. This is due to the fact that the blood-clot is given a desirable matrix in which to take form. The intaglio of the denture provides this immediately upon insertion, immediately after the surgical operation.

**Piece of Base Plate Wax Facilitates Pouring the Mandibular Impression.**—The plaster is removed from the mandibular impression in sections or pieces as in the case of the maxillary impression. Figs. 120 and 121 show the mandibular impression removed and the pieces assembled; the impression is then treated with shellac and sandarac. In pouring the mandibular impression, a similar technic to that followed in the case of the maxillary impression is employed, except that a piece of base plate wax approximately the size and shape of the palatal portion of the maxillary impression is sealed three or four millimeters below the lingual border in order to supply a "palate." This piece of wax facilitates the pouring of the impression, and results in a cast joined at the heels of the ridge—which is consequently less likely to fracture. When the cast is hard, the plaster borders of the impression are removed, after which, with the use of either dry or wet heat, the compound is removed.

**Casts Are Placed in Central Occlusion.**—After removing the plaster borders of the impression and the tray compound from the casts, the casts are sealed together in the relationship of central occlusion. Correctness of this relationship is assured through placing the maxillary cast upon the mandibular and noting that the facets of the teeth of the casts assume the same relation as the facets of the natural teeth assume in the patient's mouth. If the position or scarcity of the patient's teeth makes it uncertain as to whether correct central occlusion can be determined by superimposing one cast upon the other in order to note the relation of the facets—for example, the patient may have an almost full quota of maxillary teeth but six or seven only in the mandible, or the teeth in the mandible may alternate with those remaining in the maxilla—it is necessary to provide a central occlusion guide.

**Shape of the Beeswax Is Important.**—Pure beeswax is employed for this purpose. The amount used will be determined by the size of the patient's mouth; the piece should be large enough to cover the

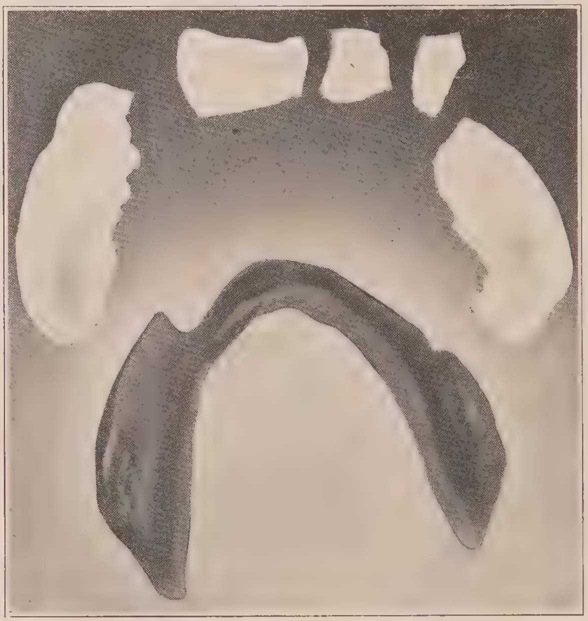


Fig. 120.—The mandibular impression is removed in pieces.

Fig. 121.—The mandibular impression assembled.

occlusal and incisal surfaces of all of the mandibular teeth and the entire ridge. The thickness of the piece must be sufficient to register an impression of both ridges wherever any of the natural teeth are missing—when the patient closes upon it. In order to cover the area desired, the piece of beeswax should in shape resemble the heel of a

man's shoe. A *roll* of wax is not satisfactory, because it is too easily distorted when it is being removed. If shaped to resemble the heel of a man's shoe, the apparently superfluous portion of the wax which extends from tuberosity to tuberosity will be found especially helpful in preventing distortion. This portion, of course, is the first to be inserted and the last to be removed.

The piece of beeswax is warmed and kneaded until it is plastic and has assumed the shape suggested. This is placed upon the mandibular teeth and the patient—seeing the dentist "snap" his teeth together in an habitual closing movement of the mandible with stress upon the molars—closes in central occlusion. In order to assure himself of the correctness of this occlusion, the operator may cut away a portion of the beeswax in order to expose one or two points where he has previously noted that the teeth come together in correct occlusion. If these are found in correct occlusion, he may legitimately conclude that the correct central occlusion has been registered and that the teeth of the casts, when fitted into this beeswax guide, will be in correct relationship to one another.

**Wax Is Not Pushed Around the Teeth.**—The beeswax is *not* pushed up around the teeth at any time, since to do so will render it more difficult to remove from the mouth without distortion, and also render it more difficult to assemble the casts.

The beeswax is carefully removed from the mouth and placed in cold water. When thoroughly chilled, the excess water is removed by holding between the fingers and with a not too vigorous jerk being thrown from its surface. Any water remaining in the depressions caused by the teeth may be blown out with the aid of compressed air or with the chip-blower.

**Fitting the Casts into the Beeswax Guide.**—The cast which has the lesser number of teeth is the first to be fitted into the beeswax guide. If, at some point, a bulk of beeswax prevents the operator from fitting the cast to the guide readily, that portion may be trimmed away by means of a hot knife, care being exercised to avoid cutting away impressions of the occlusal surfaces of the teeth or any portion of the crest of the ridge. Fig. 122 shows the beeswax just after being removed from the mouth; Fig. 123 shows the beeswax trimmed to facilitate placing of casts. It is sometimes necessary to cut away a portion of the beeswax in order that the operator may see that the contact between the cast and beeswax guide is in reality a contact. The operator may also assure himself of this contact by observing

closely the beeswax guide at a point or points where opposing teeth have almost eliminated the wax in coming together. When the cast has been fitted into the beeswax guide, a hot spatula is used to seal the guide to the cast at three or four different places.

The other cast is placed into the impression on the other side of the beeswax guide and the two casts, with the guide between them, are pressed together until any slight imperfections in adaptation are overcome. This cast also is then sealed fast.

**Luting the Casts to the Articulator.**—With the casts sealed together in central occlusion, the case is luted to the articulator (Fig. 124). In doing this, the occlusal plane of the teeth on the casts should be equidistant from the upper and lower bows of the articulator, and the casts should be placed near the incisal guide pin within a range of five to ten millimeters. This will be a convenient distance from

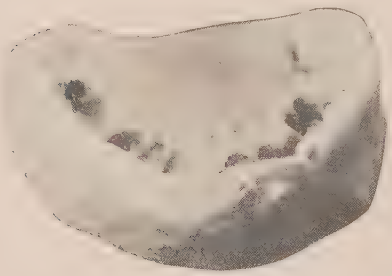


Fig. 122. -The beeswax guide in securing proper relationship of the casts, as it appears just after removal from the mouth.

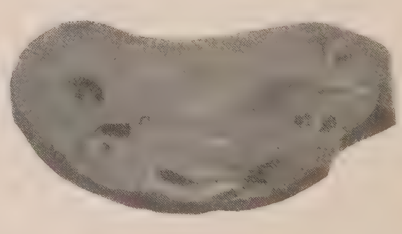


Fig. 123.—The beeswax guide after it has been trimmed to facilitate placing of casts.

the guide pin to permit easy manipulation of wax, teeth and the articulator. There is no occasion to use the face-bow, because the relation of the maxillary cast to the mandibular cast will not be altered after luting to the articulator—in fact, this relation must not be altered after it is once established. In referring to alteration of the relationship of the casts, the author has in mind the loose practice of "opening" or "closing the bite."

**Selection of the Teeth.**—The next step is to set up the teeth selected for the denture, in their places upon the cast. The teeth are selected with a view to reproducing as exactly as possible the size, color and individual markings of the patient's teeth which are to be removed, and to supply any others which the patient may have lacked; in some instances there may be a reason for departing from this

principle according to which the artificial teeth are selected, and such instances are not unusual.

**Trimming the Cast.**—All of the teeth of the maxillary cast to the left of the median line are cut out and all of the tissue of the buccal and labial marginal roll is cut away until there are no under-cuts. In fact, the operator trims until he has performed upon the cast an operation which he should regard as an ideal surgical operation, if

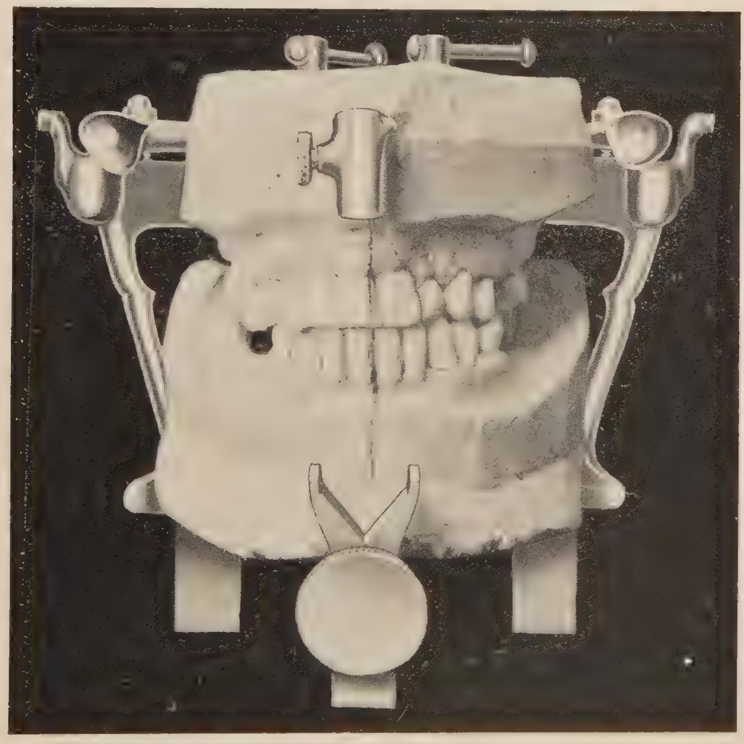


Fig. 124.—The casts sealed together in central occlusion are luted to the articulator.

he were to secure the same results in the patient's mouth. After some experience in setting up the teeth, the operator will probably prefer to cut out both maxillary and mandibular teeth and tissue as in Fig. 125.

**Arranging the Teeth.**—The selected teeth are now set up in occlusion with the teeth of the mandibular cast, and are sealed in position. The teeth of the mandibular cast on the left side are now cut out and their places supplied in similar manner (Fig. 126). The teeth on the

right side are replaced after the same method. The palatal portion of the cast is now supplied with one thickness of base plate wax and the waxing up of the case completed. Detailed method of waxing up a case is presented on pages 82 to 89.

In instances in which the operator has any doubt as to whether the patient is in full accord with the case as it now appears, he will wisely arrange an appointment and secure the patient's final approval before the case is vulcanized and finished.

The processes of flasking, vulcanizing, and polishing are the same

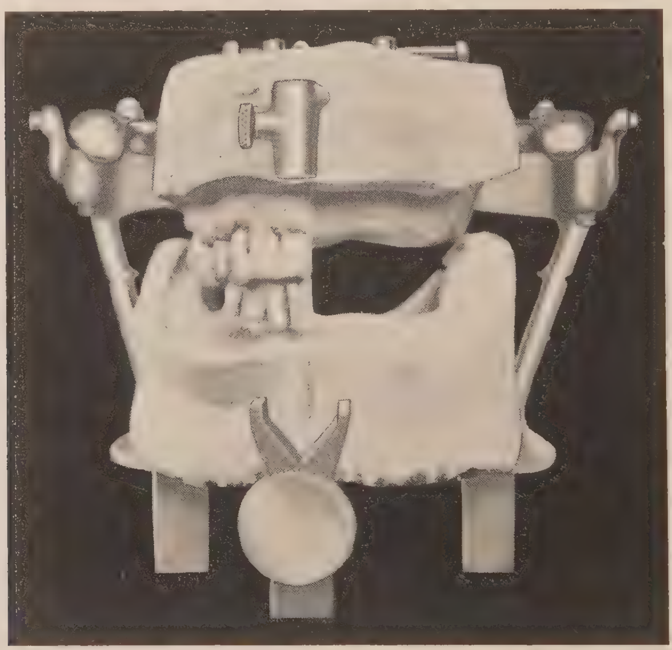


Fig. 125.—If the mandibular and maxillary teeth are cut out on one side of the median line the teeth of the other side will preserve the correct relationship of the casts.

as described on pages 89 to 113. The portion of the dentures which is to ride upon the tissues is highly polished with pumice and whiting.

The next step is to provide a guide for the oral surgeon, in order that his operation will secure, as nearly as conditions permit, the result which has thus been anticipated in the laboratory. Since the guide is designed to suggest the minimum only of tissues to be excised, any radical excisions necessitated by pathological conditions will in no wise affect the preparations made by the prosthetist to supply satisfactory dentures.

**Celluloid Guide as Prepared by Dr. Sears.**—Dr. Victor H. Sears of Salt Lake City, Utah, employs for the purpose suggested, a transparent celluloid base. The author employs and recommends Dr. Sears' method, which is as follows: the maxillary denture just finished, as described above, is poured with plaster, inverted and flasked in the lower half of a flask used for vulcanite cases. When the plaster has hardened, the denture is removed; this lower half is now dusted with powdered soap stone and rubbed to a glossy surface by means

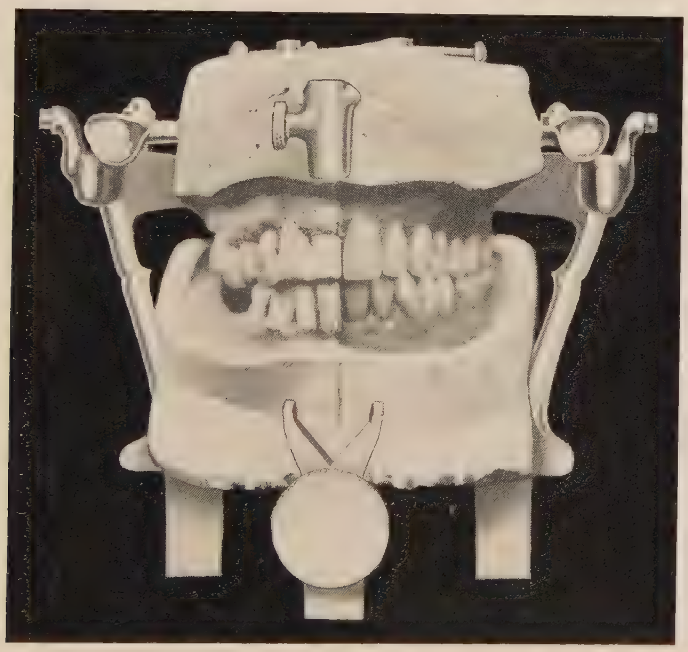


Fig. 126.—The selected teeth are occluded on one side.

of a piece of cloth or pledget of cotton. The upper portion of the flask is now placed in position and poured. When the plaster is hard, the case is placed in boiling water and allowed to remain until thoroughly heated. It is then removed and a piece of celluloid $^{25}/_{1000}$ of an inch in thickness is placed between the two halves of the flask. The two halves of the flask are then placed in a flask press, and while in boiling water are brought slowly together as closely as possible. The flask remains in the press until thoroughly cold; if it is desirable to hasten the cooling process the flask may be immersed in cold water. When cold, the flask is opened, the form removed, and the

excess celluloid is trimmed away with a pair of shears. Except for its transparency, the base resembles one made of Trubase or other base plate material.

**How the Guide Is Used.**—After the oral surgeon has removed the patient's teeth and any pathologic areas which must be removed without regard to the question as to whether the resulting ridge form will best suit the prosthetist's purpose, the celluloid base is inserted and any excess process may then be noted through this transparent form. When this excess is removed, the transparent form will seat itself palatally without impinging upon the buccal or labial portions of the ridge.

The same result may be obtained in the case of the mandible, by following a similar technic.

**First Dentures Should Be Worn Continuously.**—The dentures are inserted by the oral surgeon and the patient is instructed to wear them continuously. Ordinarily, they may be worn with a fair degree of comfort for forty-eight hours without removing, but in case the dentures are found too uncomfortable, the patient may remove them at the end of twelve hours. After cleansing them thoroughly, they may then be worn for another period of twelve hours or longer. When the dentures are removed, the patient will find it refreshing to rinse his mouth repeatedly with a solution of hot salt water or with some well diluted proprietary mouth wash. At the end of this forty-eight hour period, the patient should return to the prosthetist in order that any slight imperfection in occlusion may be detected and the dentures mounted upon the articulator and ground to perfect the occlusion. (See Chapter I on securing central occlusion at the time of grinding.)

**Occlusion Rests Instead of Dentures.**—If the patient's occupation and social engagements are not such as to make imperative, or justify the expense of immediate denture service such as has just been described, occlusion rests, at least, should be supplied.

In supplying these, an impression of the teeth, before removal, is taken as in other cases in order to provide a record. A second impression is also taken; this one is taken after the teeth are removed. This is not intended to be closely accurate, but to approximate the tissues. It is taken with a metal tray and plaster of Paris.

**Impressions of Tooth Sockets Should Be Cut Out.**—Impressions of the tooth sockets should be scraped out until the impression appears to have been taken of continuous tissue. It has been the author's

experience that few dentists have the courage to cut out of their impressions the impressions of the tooth sockets, and that this is notoriously true of men who send their cases to commercial laboratories. Mouths that would have been in incomparably better condition, if the impression had not been taken until the sockets had filled with granulation tissue, are, through such lack of courage, left in a ragged condition; and the ridges are left with humps and hollows until the whole looks a great deal like a child's sand-table study of physical geography. The reader will concur readily in the observation that the dentist has a splendid opportunity through the use of immediate dentures or the employment of occlusal rests to conform the tissues to the crest of the ridge, and to form blood clots in the matrices of the bases so as to round out this tissue to its physiological limit.

**The Impressions Are Poured with Plaster of Paris.**—When the maxillary impression has been poured with plaster of Paris, it is allowed to harden while the mandibular impression is taken. The mandibular impression is taken with plaster also. If the impressions are given a coating of liquid silex before they are poured, it will be easy to remove the casts.

**Occlusion Rests Are Made of Compound upon Base Material.**—The occlusion rests are constructed of Kerr's perfection modeling compound upon a base made of some such material as Graft's, Trubase, or Alston's base material. The technic of adapting this material to the cast is given in Chapter I, pages 57 to 59. When the bases are finished, the edges should be smoothed and the compound which is built upon them should be left in such condition that the tissues will not be irritated, because often these rests are worn much longer than either the dentist or the patient anticipates. The compound is added and conformed very much after the manner employed in adding wax to the occlusion rims (see page 60) except that the compound extends from the region of the distal cusp of the second molars anteriorly only as far as the region of the bicuspids.

**Trying the Maxillary and the Mandibular Occlusion Models in the Mouth to Get Proper Relation—or Occlusion.**– Gum tragacanth (powdered) is sprinkled upon the maxillary base; it is inserted and the mandibular base is then inserted and its occlusion with the maxillary noted. The compound is trimmed away to meet the requirements of the normal relation of the jaws, which in this instance is determined very largely by the position of the lips. The mandibular base is then removed and the occlusal surface of the compound is rewarmed by

Fig. 127.—Profile view of patient before removal of natural teeth.

Fig. 128.—Patient before removal of natural teeth (smiling).

Fig. 129.—Profile view of patient before removal of natural teeth (smiling).

projecting a small flame against it. It is returned to the mouth and the patient will close upon it correctly. He will close correctly because of the fact that there is nothing in front upon which he can

Fig. 130.—Profile view of patient with artificial dentures.

Fig. 131.—Patient with artificial dentures (smiling).

Fig. 132.—Profile view of patient with artificial dentures (smiling).

"bite," and also because of the fact that the jaws are tired, since they have been without any rest or support since the teeth were surgically removed nearly an hour before.

The degree to which the jaws will close will depend upon the de-

gree to which the compound has been warmed, and this is usually too great. Accordingly, care should be taken that the surface only is warmed—just enough to get an imprint of the maxillary base.

The mandibular base is removed and chilled and the compound smoothed and narrowed buccolingually so as not to interfere with the lateral movements of the mandible.

**Tissues Unite Quickly Under These Bases.**—Fig. 133-*A* shows the bases completed ready to be placed in the mouth and worn until the tissues are ready for the first dentures. In most instances, when these bases are inserted in the afternoon—for example, about four o'clock—it will be found that about ten o'clock the next morning the tissues will present a united appearance. While wearing these bases, the patient should remove and wash them at least once in twelve hours, and more often, if they cause too great discomfort; each time

Fig. 133-*A*.—Completed occlusion rests.

the mouth should be rinsed with a solution of hot salt water or proprietary mouth wash, as has been suggested earlier in this chapter.

**''Immediate'' Varies in Meaning.**—In case ''immediate denture service'' is not provided in keeping with the meaning of ''immediate'' as indicated in the early portion of this chapter, the period of time within which the dentures may be provided, after temporary bases or occlusion rests have been provided, varies according to the condition of the mucosa. In some instances, the mucosa will bear the stress of impression-taking before the effects of the anesthetic are dissipated; in other cases, there will be an interval of twelve, twenty-four, or thirty-six hours, and sometimes even as much as seventy-two hours may elapse. However, if the anterior teeth are set upon these bases, the patient will often be content to wait until the tissues are thoroughly healed.

**Advantages to Be Gained Through Immediate Denture Service.**—While several advantages are gained through the immediate construction and wearing of dentures or occlusion rests, the chief one is

that the patient immediately begins to grow accustomed to wearing bases. In addition to this one—which in itself justifies the construction of either dentures or rests—the wounds are bandaged, hemorrhage is checked, the patient's jaws are rested, and he is afforded a relief from the unnatural feeling which accompanies the loss of his teeth. This in turn gives him a satisfaction which will promote an assurance of the satisfaction he will yet derive from wearing properly constructed artificial dentures.

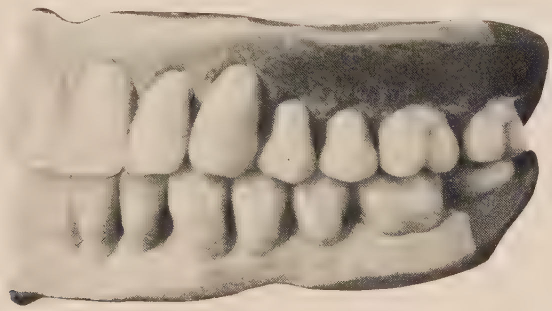


Fig. 133-*B*.—Completed dentures.

**Immediate Denture Service Within Fifteen Minutes after Teeth Were Removed.**—Figs. 127 to 132 are photographs of a patient supplied with immediate dentures. These were placed in the mouth within fifteen minutes after the surgical removal of the teeth and preparation of the mouth. The last three photos of the patient were taken a week later. Except for purposes of cleansing, the dentures were worn continuously until other dentures were constructed. Fig. 133-*B* shows the immediate dentures.

# CHAPTER V

## PHYSIOLOGICAL, ANATOMICAL, AND OPERATIVE PHASES WHICH INFLUENCE FULL DENTURE CONSTRUCTION

**Varying Physiological Tonus May Result in Varying Satisfaction in the Wearing of Dentures.**—Changing physiological conditions often have rendered useless the most accurately constructed and most splendidly adapted artificial dentures. Satisfaction in the wearing of dentures may be interrupted temporarily through a lowering of the general tone of the system induced by weariness, strain or ill health. It is a fact of common experience, that during the afternoon or late evening hours, muscles have become fatigued, nerves are unstrung and tissues are more or less exhausted. Shoes that may be worn with comfort during the morning hours are unendurable in the afternoon, artificial limbs are a source of irritation as the day draws to a close. Often relief is gained by laying the artificial eye upon the shelf. Accordingly, when local indications fail to suggest the source of occasional imperfect adaptation, the prosthetist will wisely make inquiry regarding the patient's health.

**Youth and Good Health of Patients Make Task of Prosthetist Easier.**—The younger the patient the more often will the condition of the tissues be satisfactory; with age come diminution of vigor, reduced tension, and a general relaxation throughout the system. Whether young or old, a patient in good health may be more easily provided with satisfactory dentures than is possible when a patient is in ill health, while to the prosthetist a convalescent person is physiologically more acceptable than an individual in declining health.

**Important Physiological Factors.**—Physiological factors of real importance in the retention of artificial dentures are the general state of health, the muscles of the mouth, the saliva, the condition of the mucous and submucous tissues, together with the condition of the alveolar process underlying them. The muscles of the mouth and their attachments give the prosthetist the least concern in his effort to secure the best retention for the denture. With reference to these, it is necessary only to see that the denture does not impinge.

**Good Tonus of Mucosa and Underlying Healthy Structure Highly Desirable.** Conditions which physiologically constitute an individual

an ideal patient so far as the wearing of artificial dentures is concerned, will be a mucous tissue of healthy tone and underlying process in good condition. Factors favorable to retention are discussed at greater length in the chapter entitled, "Mouth Examination and Prognosis."

**Desirable Mucosa Provides Valve Seal for Denture.**—The mucous tissue will be characterized by a varying degree of thickness, but sufficiently liberal in this respect to afford a covering of mucous and submucous tissues for the underlying bony structure. This will indicate through its color a desirable quality and quantity of blood supply, which, together with a firmness suggesting stability and relative immobility, will assure a physicophysiological base upon which the mechanical masticatory substitute may confidently be placed, since tissue of this kind furnishes a highly desirable valve seal.

**Oral Surgery Welcomed by the Prosthetist.**—If the health of the patient is paramount—and this is never seriously disputed—and if the health of the patient is more adequately safeguarded through a removal of infected areas, and if, thereafter, more efficient, comfortable, and esthetic substitutes may be constructed and worn, oral surgery must be acknowledged and welcomed by the prosthetist. In fact, simple extraction of the teeth without cleansing of pus pockets or removal of necrotic substance may be more harmful to a patient who is ready for artificial dentures than if the teeth were allowed to remain for a while longer.

A great deal of unjust criticism has been directed against oral surgeons by critics who have no knowledge of the conditions necessitating the operations as performed. It is impossible to determine exactly beforehand the extent of the tissue which must be removed, and when removed, it is equally impossible for a nonobserver to judge how nearly the areas removed corresponded to the substance which was necrotic. The author's experience has been such that he welcomes the skilled oral surgeon as an ally of the patient, and he avails himself of the results of surgical removal of teeth and surgical preparation of the mouth.

**Reason for Including This Presentation of Technic.**—The author is, of course, interested in the surgical removal of the teeth and the surgical preparation of the mouth because of the advantages accruing to the prosthetist. He believes that this aid to the specialist in coping with difficult cases will be of even greater benefit to the general practitioner. While the oral surgeon is not primarily concerned with preparing the mouth in order to assist the prosthetist in providing the

most acceptable artificial dentures, it is easily possible in most instances to serve the purposes of both.

**Extent of Operation.**—The question as to extent of operation is purely an academic one; in a particular case, the surgeon will be guided by the condition of the teeth and the areas surrounding them, and restrained perhaps through a knowledge of the patient's decreased vitality. It is, of course, not always necessary to the patient's health and prompt recovery to remove completely the external alveolar plate; this has been sufficiently demonstrated by the innumerable cases of recovery following extractions in which no curetting at all was done, unless the incidental breaking up of granulomatous areas may be so termed. In general it may be said that in the majority of cases the operator may remove all obvious areas of infection and provide adequate drainage; he need not then be unduly concerned about possible intangible infected areas.

**Serving the Interests of Patient, Surgeon and Prosthetist.**—There are but two reasons for the removal of teeth. Some may be removed because of infection, and some because of location or position. Those teeth which are so located or malposed as to prevent the construction of adequate substitutes should be removed. Of course, the cases first mentioned will far exceed in number those in which the teeth are removed because of interference with proposed substitutes. In cases in which infection is present, the visible area of infection is often small compared with the area actually involved. In serving the prosthetist at the same time that the oral surgeon serves primarily his own object, he will serve the patient's best interests by surgically removing all visible diseased tissue, obliterating all undercuts, and resecting the alveolar process in the labial region, if this is necessary to permit the placing of such artificial anterior teeth as will satisfy the esthetic requirements of the case. There are cases, of course, which because of pathological conditions permit little consideration of the requirements of the prosthetist. Criticism is often due to a lack of knowledge regarding the laws of physics which affect the retention of artificial dentures.

**Surgical Preparation Assures Immediate Dentures.**—So far as the patient is concerned, surgical preparation of the mouth is welcomed, as soon as he is informed as to the nature of the preparation and its relation to the earliest reception of artificial dentures. There are few patients who do not regard the time element as of great importance; as soon as they know that their natural teeth should be removed, they wish to know how soon they may have substitutes. They may

be assured that the artificial substitutes may be provided immediately, if the operator while removing the teeth is permitted to anticipate very largely the natural resorption.

**Preparation Enhances Esthetics.**—Surgical preparation of the ridges is especially welcomed by patients who are concerned about facial appearance. Without hesitation, the patient may be assured that a superior esthetic result may be obtained if sufficient process is removed to permit the use of long anterior teeth; these will prevent, while laughing or speaking, the display of the always unsightly gum vulcanite.

**Preparation Is in the Interests of Physical Demands of Retention.**—Men may not be so much interested in the esthetic advantages as women patients are, but masticatory efficiency is advanced by proper surgical preparation. The mouth may be prepared in such manner that the artificial teeth may be properly placed in accordance with the physical demands of retention.

**Technic Assures Less Pain and Discomfort.**—The patient may also be assured that the infected areas may be obliterated with less pain and discomfort, during and subsequent to the operation, than is usually associated with simple extraction. Strict attention to asepsis, and proper preoperative and postoperative care will result in far less inconvenience to the patient, and there will follow far less disturbing systemic reaction than that which accompanies a great many simple extraction cases.

**Prosthetist Provides Helps for the Oral Surgeon.**—The oral surgeon may wisely study the study cast before he begins the operation; it will often enable him to visualize the outlines of the finished preparation. During the operation, he may avail himself of the celluloid guide supplied by the prosthetist, as indicated in the chapter on "Immediate Denture Service."

**Conduction Anesthesia Is Most Acceptable.**—When the general condition of the patient warrants it, either the maxillary or the mandibular ridge may be prepared at one sitting. Prior to the operation, a careful examination of the patient should be made to determine blood pressure, organic lesions, and general physical condition. Sometimes the use of conduction anesthesia is contraindicated, because of the patient's health. This is seldom the case, however. The aid of conduction anesthesia is very acceptable. Not only is the time required less than that consumed when a general anesthetic is employed, but conduction anesthesia enables the operator to have the cooperation of the patient, and gives the patient the advantage of a continued anes-

thesia for some time after the operation is completed. This advantage to the patient is that derived from a gradual disappearance of the effects of the anesthesia; a gradual restoration of normal sensibilities is much more acceptable to the patient than the experience accompanying the full force of the effects immediately following an operation.

**Preliminary Incision from Tuberosity to Tuberosity.**—When satisfactory anesthesia has been obtained in the case of the maxilla, iodine

Fig. 134.—An incision is made from tuberosity to tuberosity about two millimeters above the highest point of the festooned gum of the maxillary ridge.

(3½ per cent) is liberally applied to the surfaces involved in the proposed operation. Beginning at the right tuberosity, an incision is made through the mucoperiosteum to the process; this incision is made about two millimeters above the highest point of the festooned gum. It is extended at this height completely around the arch from

one tuberosity to the other, and also continued around the palatal border in the same manner (Fig. 134). This separates the interstitial gum tissue, which is usually diseased, from the more healthy tissue above, and facilitates the retraction of the mucoperiosteum without undue laceration and trauma. With further presentation of this technic, other advantages in making this preliminary incision will become apparent.

**The Operation.**—The mucoperiosteum is now retracted to a line approximately in a line with the apices of the teeth (Fig. 135), and the

Fig. 135.—A schematic drawing of an ideal resection in a case presenting no pathological involvement. This shows the mucoperiosteum retracted to a line approximately in line with the apices of the teeth.

teeth are removed together with the gum septum. The interstitial process is then split in order to facilitate the removal of such portions of the buccal and labial plates as may be necessary to give the desired shape. This tissue is then removed with the single edge Rongeur bone forceps (Fig. 136). At this time, the operator removes and cleanses mechanically the granulomatous tissue and smoothes the remaining process with bone curettes.

After the uneven or rough portions have been smoothed or planed down by this means,—Rongeur forceps and bone curettes are preferred to the use of burs or stones, because the debris is removed in more cleanly fashion and with less traumatism to the tissues—the edges of the mucosa are then approximated. It will be found that in nearly every instance the edges approximately meet. A space of two or three millimeters between these edges is preferred in order to prevent the formation of a soft pendulous ridge, and in order to provide

Fig. 136.—Removal of prominent portions of the alveolar process is performed with the use of Rongeur forceps.

drainage. If these edges meet, they should be trimmed back so that the space indicated is left. It is apparent that to trim these edges neatly with the scissors will be rather difficult, since the flap is loose and difficult to hold. It is at this stage that the value of the preliminary incision will be appreciated. It usually makes it unnecessary for the operator to trim the edges after the tissues have been loosened. When the proper length has been obtained and all debris has been removed, the flaps are approximated and sutured. The immediate dentures or occlusion rests may now be inserted.

**Sutures Are Soon Removed.**—The sutures are placed continuously, the needle punctures being about fifteen millimeters apart (Fig. 137). Care is exercised so that no tension is exerted on the tissues, since under tension the mucosa readily tends to slough. The sutures may be removed at the end of three days and even after a shorter period.

Postoperative pain is unnecessary and avoidable; the operator should make prescription to prevent it.

**Providing Dentures for Patients Whose Teeth Have Been "Extracted."**—Frequently, the prosthetist has patients whose teeth have

Fig. 137.—Gum tissue sutured.

been extracted by an operator who apparently thought only of extracting the teeth. In an endeavor to supply satisfactory temporary dentures for such cases, the prosthetist is decidedly handicapped. Several years ago, the author had it brought to his attention through a series of radiographs and practical cases, that efficient masticatory substitutes could not be provided for mandibles the ridges of which presented a serrated condition because of alveolar tissue which had not yet resorbed. Often this is true also of the maxilla. During the subsequent years the author has observed a number of such cases, has personally witnessed the operations for removal and noted the satis-

Fig. 138.—Radiograph of spinous process following a comparatively recent extraction.

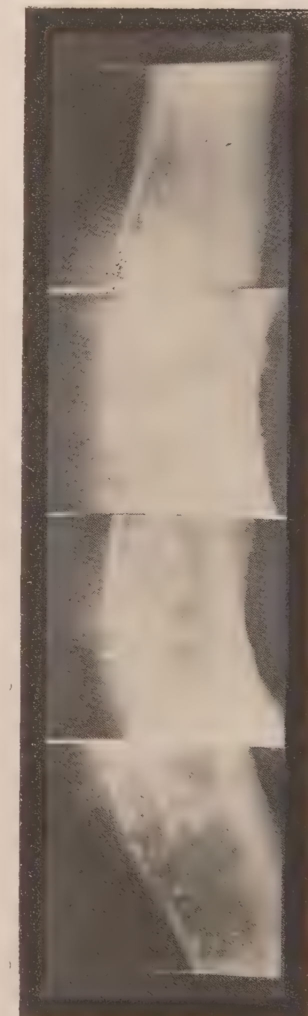


Fig. 139.—Radiograph of spinous process. Condition several years after teeth were extracted. (Courtesy of Dr. William A. Colburn.)

factory results which have been obtained. Figs. 138 and 139 show sectional radiographs of spinous processes which are characteristic of the condition just mentioned. Not only is the prosthetist unable to supply satisfactory dentures immediately after the teeth have been extracted, but often this condition continues through a period of years and the spicules of process remain unresorbed. At the time the teeth were removed, these irregular portions might easily have been removed and the alveolar process smoothed in such fashion that the prosthetist's efforts would not be obstructed. Fig. 140 is from the photograph of a cast made before the spinous process was surgically removed.

While these spinous processes may not be accompanied by any "apparent" pathological condition, under the stress of mastication,

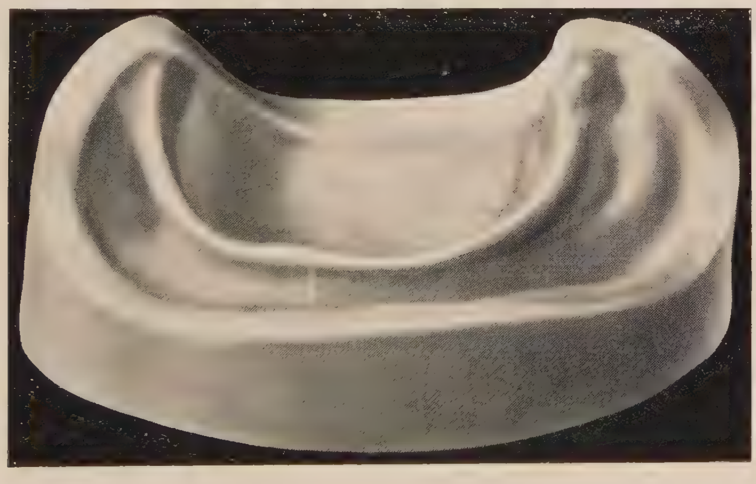


Fig. 140.—Cast of ridge before operation to remove spinous process.

they tend, because of their spine-like character, to press through the overlying tissues; the patient, through fear of pain, unconsciously avoids putting any real stress upon the bolus of food. Therefore, when an edentulous patient of this type has permitted ample time for the resorption and the resorption has not taken place, they should be surgically removed. A symptom of the condition justifying such removal is the appearance of a blanched spot on the mucosa. This spot is characteristically different in appearance from that which is caused by irritation which may be ascribed directly to a trauma produced by an elongated cusp or a malocclusion of the dentures. In an individual of strong vitality and in vigorous health the blood stream is capable, through its own corrective processes, of promoting such regeneration

of tissues as will prevent the spicules from becoming a source of irritation. However, when the irritation continues, relief may be obtained through removing the source.

**The Operation.**—The condition of the alveolar process requiring operation is more often found in the mandible than in the maxilla.

Fig. 141.—An incision is made from posterior extremity to posterior extremity of the ridge.

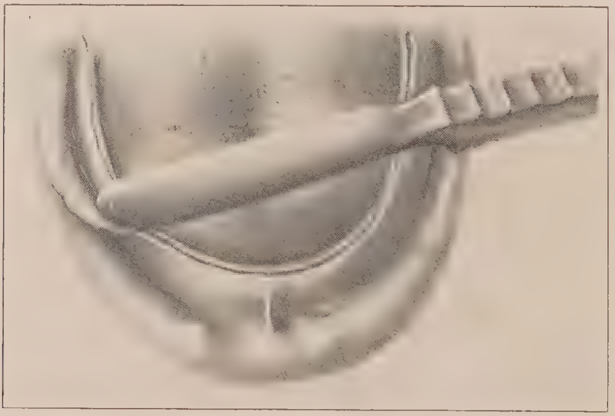


Fig. 142.—The periosteum is fearlessly retracted.

The mandible is anesthetized and an incision is made from posterior extremity to posterior extremity of the ridge (Fig. 141). With a periosteal elevator the periosteum is radically retracted to expose the alveolar process. This retraction should expose more of the process than is to be resected, in order that an adequate view of the case may be secured (Fig. 142). With the curved Rongeur forceps (Fig. 143) and with bone curettes the ridge is properly reduced and smoothed.

The ragged mucosa is trimmed, the edges approximated, and sutured (Figs. 144 and 145). Fig. 146 shows a cast of the same ridge several months after the operation. Cross sections through the cuspid region

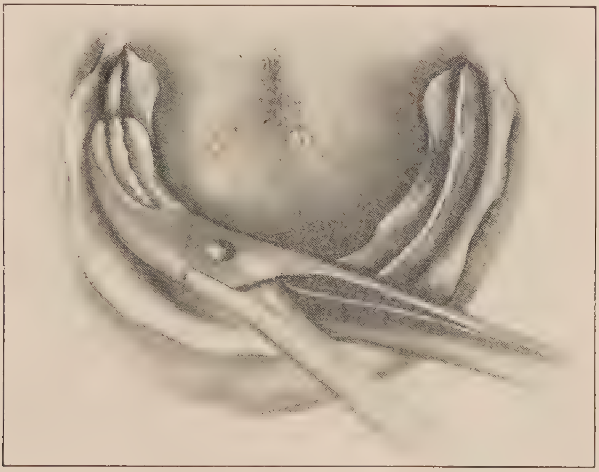


Fig. 143.—The curved Ronguer forceps are used with bone curettes in reducing the ridge.

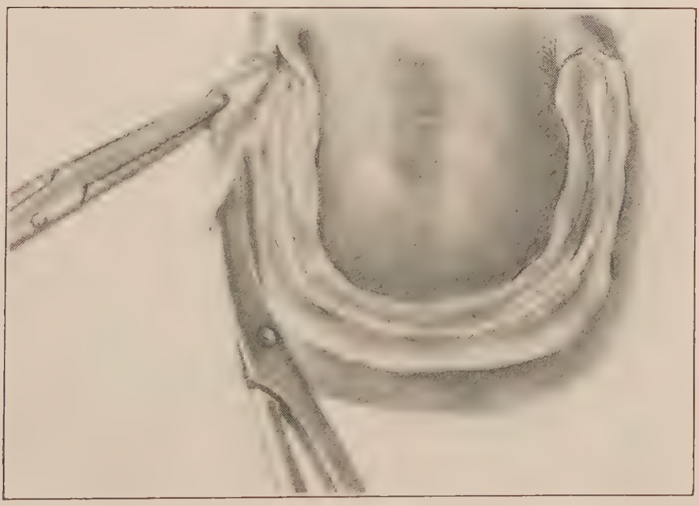


Fig. 144.—The edges of the mucosa are trimmed and approximated.

and through the molar region of casts made before and after an operation performed to reduce a spinous ridge, are shown in Fig. 147.

**Removing Excessive Tissue Which Prevents Stable Seating of Denture.**—Not infrequently the prosthetist may avail himself of the oral

surgeon's aid in correcting another undesirable condition. A patient, who has but six or eight teeth in the anterior portion of the mandible, wears a full denture and concentrates his masticating efforts upon these anteriors. The force of mastication thus centered upon the anterior portion of the ridge causes a resorption of the alveolar process in the maxilla corresponding to the width of these mandibular teeth, but there remains a heavy layer of unusually mobile and compressible mucosa over this resorbed process. During the process of masticating, the maxillary denture makes very noticeable excursions in keeping with the excursions of this movable tissue upon which the base of the denture rests. During the resorption of this section of

Fig. 145.—The flaps of mucosa are sutured.

the alveolar process, the patient has found mastication an increasingly unsatisfactory task, while the changing occlusion, perhaps accompanied by disease, has affected the few mandibular teeth.

**Excessive Mucosa Is Excised with Shears.**—Methods of different types have been suggested and practiced by various operators in compressing this tissue, in making provision for it beneath the denture, and in other ways favoring it during impression taking; the method which recommends itself most strongly to the author and which he recommends as the most generally satisfactory one in dealing with excessive tissue of this kind, is to remove entirely the superfluous portion. The operation is a very simple one. The tissue needs only to be infiltrated with an anesthetic when, with a small pair of curved-beak shears, it may be cut away in a continuous strip, beginning in

the region of the second bicuspid and ending in a similar region on the other side. It may be well to suggest that shears are employed because of their superior cutting leverage. The operator should press the shears hard against the process as if a portion of this were to be excised. The outline of the tissue to be cut away should be noted

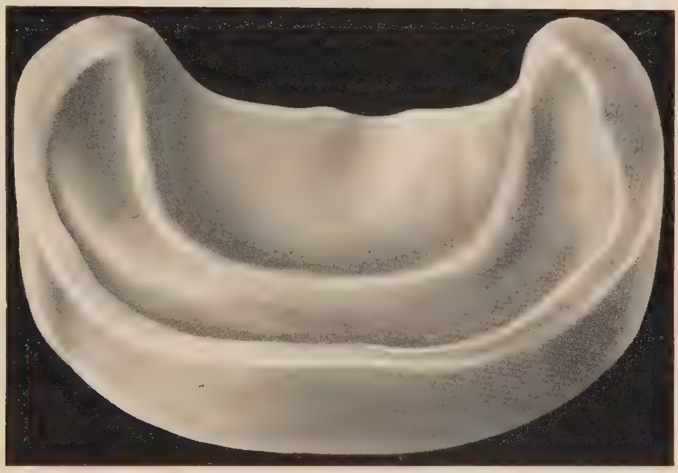


Fig. 146.—Cast of ridge several months after the operation.

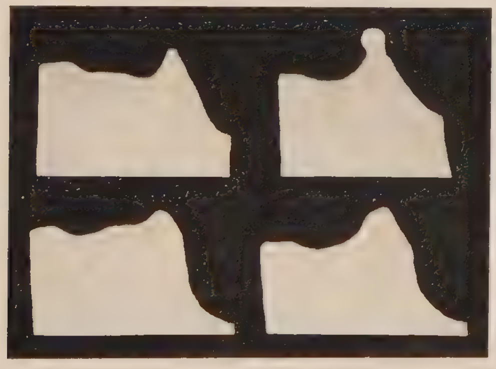


Fig. 147.—Cross sections through molar and cuspid region of casts before and after operation to reduce spinous ridge.

before infiltration, since, when anesthetized, it presents a firm appearance and the prosthetist may then be reluctant to cut it away sufficiently.

**Treatment Following Operation.**—After the operation, the denture in the corresponding portion is filled with orthoform paste and the patient permitted to wear it out of the office and until the wound is

healed. The patient should be instructed to keep the healing tissue as clean as possible. Any attempt to preserve any of the tissues to assist in covering the denuded area is superfluous, since the old denture will serve this purpose. When the healing period has elapsed, the denuded area will have been supplied with new tissue so that the case anatomically will be one of encouraging possibilities for the prosthetist. At the end of three or four weeks, the new denture may be constructed or the old one rebased.

**Similar Operation for Mandibular Mucosa.**—Often in a mandible, otherwise favorable, a condition is found in which, at the summit of

Fig. 148.—If the labial frenum is very pronounced, a V-shaped portion is cut out.

the ridge and along its entire length, the tissue structure presents a loose portion about four millimeters in height and of about the same breadth. This may be removed after the method just suggested for excising the superfluous tissue of the maxilla.

**Labial Frenum May Be Excised.**—If the labial frenum is very pronounced dipping down and attaching in the median line upon the crest of the ridge, it may interfere with the retention of the maxillary denture. It is possible also that this frenum may be so attached that provision in the denture to avoid it will result in the weakening of the denture. This is often true in the case of continuous gum dentures, in the construction of which the operator desires to avoid

the sacrifice of strength incident to making allowance for the presence of a pronounced frenum. A local anesthetic is employed, and just before the denture is to be inserted, a V-shaped portion of the frenum is cut out (Fig. 148). The tissue at the point of the V is sutured (Fig. 149) and the denture immediately inserted and then worn continuously, except for cleansing purposes.

**Enlarged Raphe Should Be Removed.**—In a case in which the raphe is enlarged and covered with hard tense tissue, proper seating of the denture becomes a real problem. If a relief is provided in the base

Fig. 149.—The tissue at the point of the "V" in the labial frenum is sutured.

of the denture, this serves to encourage its enlarging tendency, and thus serves merely as a temporary expedient. If the enlarged portion is near the posterior palatal border of the denture, it is difficult and often utterly impossible to secure satisfactory results with post-damming. In such cases the most satisfactory correction of the difficulty is secured through simple surgical removal.

**The Only Condition of Tissue Justifying Full Vulcanite Denture.**—A condition of tissue which presents a prosthetic problem and which does not admit of easy disposition through a surgical operation is that in which the vault and ridges as well are covered with a hard, tense mucosa. This condition is characteristic of those cases in which attempted mastication has been carried on for years without the aid of

dentures, and is a result of Nature's effort to assist. The hard, tense character of this structure makes it impossible to imbed the base of the denture. Consequently, the prosthetist's effort to avail himself of these tissues to prevent ingress of air beneath the base and thus take advantage of the physical forces involved, is practically without effect.

The author believes this condition of the maxilla provides the single instance in which a vulcanite maxillary full denture is more desirable than one made with a metal base. The purpose served with the vulcanite base in the treatment of the condition described should be regarded also as serving to emphasize the inferiority of vulcanite bases.

**Vulcanite Denture Prescribed as an Irritant.**—The author is accustomed to employ a vulcanite denture for the purpose of changing the character of the structure upon which it rests. The denture is constructed as outlined in Chapter I, except that in packing the case neither tinfoil nor silex is used on the cast; the omission causes the base of the finished denture to have on its surface innumerable microscopic nodules. The continued use of such a base will be accompanied by an irritation of the structure immediately beneath, and this in time causes a resorption of the underlying osseous structure; when the resorption has progressed sufficiently, it is stopped by the insertion of a metal base. This vulcanite denture should not be constructed in this manner for this type of case, until the patient clearly understands the results that are anticipated and signifies his readiness to give the kind of cooperation which the operator requires. Before the denture is inserted, it is moistened with water and sprinkled with powdered gum tragacanth or other adhesive preparation. This procedure must be repeated daily and possibly two or three times or oftener daily, for a year at least, and perhaps for a longer period. There may be some discussion regarding the theory given as to the manner in which the change occurs, but the practical result cannot be misinterpreted, namely, the hard, tense tissues are changed sufficiently to permit the wearing of a metal base denture with increased satisfaction.

**The Saliva.**—The saliva is a physiological factor as well as a physical factor of importance. When this secretion is of a watery consistency, its value in adhesion is an important one; when it is of a ropy character, thick and viscous, it prevents even contact between tissue and denture. At the time of taking the impression the mouth may be temporarily cleansed of the undesirable saliva by rinsing with a diluted solution of hydrochloric (muriatic) acid. The insertion of dentures often stimulates the flow of saliva and consequently results in thinning it to an acceptable degree.

## CHAPTER VI

## PHYSICAL FACTORS IMPORTANT TO FULL DENTURE PROSTHESIS

**Artificial Dentures, from the Standpoint of Physics, Constitute a Machine.**—Artificial dentures are mechanical substitutes constructed in accordance with the laws of physics. An understanding of these laws enables the prosthetist to replace lost portions of the masticatory machine originally provided by Nature. The efficiency of this machine as restored by the prosthetist is determined largely by the degree of harmony with physical laws according to which as a machine it should be constructed.

**Retention of the Machine Is Primarily a Problem of Physics.**—The retention of artificial dentures is almost wholly a problem of physics. However, the problem is complicated, because of the fact that the base—the mucosa and underlying osseous structure—is at the same time to be considered as both physical and physiological; further, this physicophysiological combination is influenced by the psychological attitude of the individual for whom it is designed. None of these factors may be ignored in achieving the best possible results, but no dentist should be guilty of constructing a denture in which the fundamental laws of physics have been ignored. Knowledge of the laws of physics according to which a denture may properly be constructed, and be successfully retained in the mouth while functioning satisfactorily, will prepare the dentist adequately to remedy defects which may appear.

**How Atmospheric Pressure Operates.**—Atmospheric pressure always has been recognized as an important factor contributing to successfully functioning dentures. The writer is in accord with those who recognize the importance of this factor, but he believes that the actual operation of atmospheric pressure in the functioning of artificial dentures has been generally misunderstood. He wishes in this chapter to emphasize the importance of atmospheric pressure in its secondary rather than its primary effect. The average atmospheric pressure exerted at sea level is 14.7 pounds per square inch, or 1033.3 g. per square centimeter. This pressure is continuous and may be regarded as universally operative. That is to say, this pressure is exerted within the human body, as truly as it is exerted against the

outer surface of the human body. It is exerted against a denture, whether that denture is in position in the mouth or whether it is lying upon the laboratory bench. But because the air pressure is the same beneath the denture as above it, its influence has no special significance. Under a particular condition, which will be discussed later in this chapter, this pressure is of particular importance.

**Adhesion Is of More Importance in Retention.**—A physical factor of more importance to the prosthetist than atmospheric pressure is that of adhesion; when this factor is operative in significant fashion, atmospheric pressure is of practically no significance; when adhesion ceases to be significant or when it tends to lessen its force in the retention of a denture, then the force of atmospheric pressure becomes more vital.

**Facts of Physics Stressed.**—In this chapter the author desires to emphasize the following facts: *First*, adhesion increases as the area of the surface covered is increased, and its force varies with the viscosity of the medium interposed (the saliva). *Second*, atmospheric pressure increases in direct ratio to: (a) the area of surface covered; (b) the adaptation of the periphery; (c) the extension upon the soft tissues at the posterior border. *Third*, muscular control may provide a kind of friction force of importance in retention. *Fourth*, alignment of the teeth on the base is an important factor to be considered among the physical factors in retention and in mastication. Considered as a lever of the third class, each of the condyles must be regarded as a fulcrum, which ordinarily is not in accord with the anatomical facts. *Fifth*, gravity is of practically no importance.

## ADHESION

**Adhesion Considered.**—Adhesion increases with the increase of area, and in its retentive force varies with the condition of the saliva. From the standpoint of physics, the saliva serves to perfect surface contact; for this purpose abundant saliva of a thin and water-like quality is desirable. To insure the presence of a liquid medium in sufficient quantity at the moment of inserting, the operator is accustomed to place the denture in water immediately before inserting. It is obvious that the employment of a medium such as powdered gum tragacanth or some similar preparation containing a sticky substance is for the purpose of retaining the denture primarily through the force of adhesion. Thick ropy saliva prevents uniform contact between the base of the denture and the tissues and, when present, the mouth should be

rinsed with a diluted solution of hydrochloric acid. A lack of saliva in a patient's mouth is usually remedied by the insertion of dentures. The presence of foreign objects of this size is usually sufficient to promote the flow of saliva.

## AREA

**With Other Conditions Regarded as Constant, Retention Increases in Direct Ratio to Area.**—With other factors remaining constant, a denture which covers the larger area of base surface, will possess a proportionately superior degree of retention in the mouth and will consequently provide a corresponding increase in masticatory efficiency. This is according to the laws of physics, which relate to atmospheric pressure and to adhesion; both of these factors increase with the increase of surface involved.

Patients wearing large dentures are not always the patients who find the greatest satisfaction in wearing dentures, because other con-

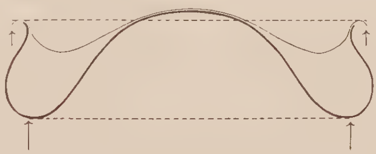


Fig. 150.—This diagram represents a cross section of a maxilla. Dark outline of original ridge form is contrasted with light outlines of ridge form after operation. Superior prosthetic advantages of the "flat mouth" are thus emphasized.

ditions are not always as favorable as they may be in the cases of patients whose dentures cover less area.

**"Area" Is Not Merely That of the Ridge.**—The area involved is not merely that of the ridge of the maxilla or mandible, it often includes an additional area extending the base buccally and labially three—or even ten millimeters in case of the maxillary denture—beyond the area ordinarily considered in securing an impression of the ridge. This is often possible and especially desirable with patients having "flat mouths." This added area will sustain added masticatory pressure and will terminate the borders against the lips and cheeks at points most effective in excluding the air from beneath the base of the denture. Fig. 151 shows a case in which the impression has been extended. Fig. 150 is a diagram representing a cross section of a maxilla. A greater area of base surface is made available than the area possible with the maxilla as outlined with high ridges and deep vault (compare length of dotted lines which indicate base

surface supporting each denture when under masticatory stress). The light line shows the possible results of an operation reducing the ridges until the mouth might be regarded by some operators as ruined so far as the prosthetist is concerned. Except for an insignificant loss of stability under lateral stress, a base resting upon the

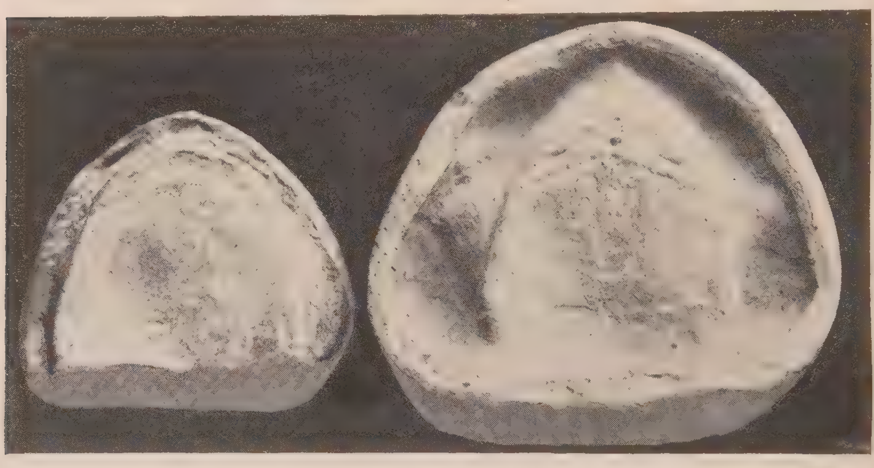


Fig. 151.—From a photograph of two casts which were used at different times in constructing dentures for the same patient.

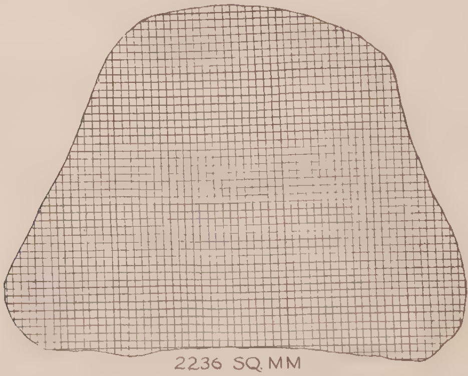



Fig. 152.—Outline of base surface covered by the denture made on the smaller cast shown in Fig. 151.

ridges following the operation will have better retention—better because of greater flat surface area, which increases adhesion and the force of atmospheric pressure, and because masticatory stress will be distributed over this larger area and its displacing effect minimized accordingly.

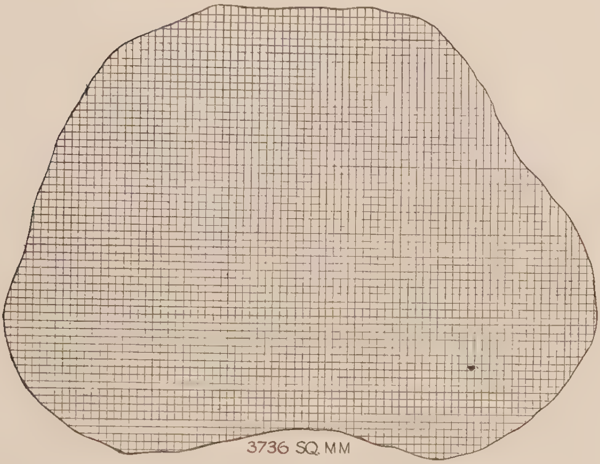
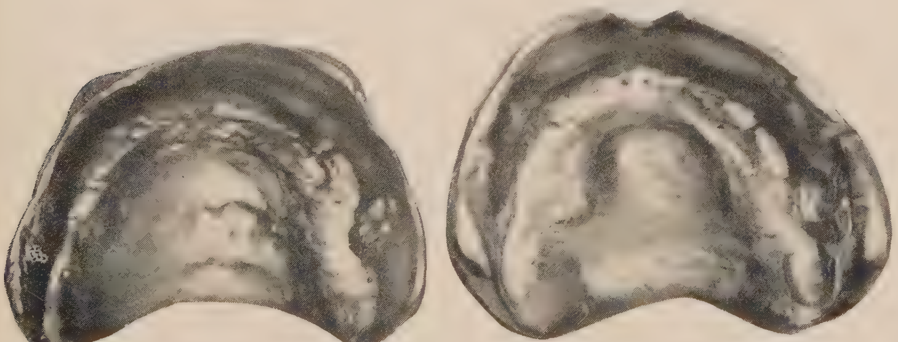



Fig. 153.—Outline of base surface covered by the denture made on the larger cast shown in Fig. 151. This denture shows an increase of area and an improvement in retention of nearly 60 per cent.

Figs. 154 and 155.—The original base constructed for a patient compared with one of increased area later constructed.



Figs. 156 and 157.—Contrasting areas of bases constructed for the same patient. The larger was constructed three years after the smaller.

**Area Not To Be Neglected in Mandibular Base.**—While area is a more pronounced consideration in the maxillary denture. the advantages of securing as much area in the mandibular base as possible are significant; attention to this phase of mandibular impression-taking and denture construction will be productive of gratifying results.

**Graphic Presentation of Increase in Area.**—A graphic presentation of the advantage to be derived from an increase in area is given in Fig. 151 which is made from photographs of the casts of a practical case; Figs. 152 and 153 show the bases of this same case outlined and divided into millimeter squares. Figs. 152 and 153 cover surfaces of 2236 square millimeters and 3736 square millimeters, respectively. While both of these dentures were constructed for the same patient, the larger shows an increase in area of more than 59 per cent, and a consequent improvement in retention in this same direct ratio. Innumerable dentures that are being worn today are capable of a similar enlargement in area and consequent increase in satisfaction to the patients. While it may not be possible to incorporate all of this additional area at one time, it may be accomplished through the construction of two or three sets of dentures during as many years. Owing to the tense condition of the cheeks and lips when the first dentures are constructed, an incorporation of too great area would find this condition operating as a negative factor and serving to tend toward the displacement of the dentures. After the patient has worn the dentures for a few months, the lips and cheeks become more mobile. Fig 154 is from a photograph of the original gold base denture constructed for a patient, while Fig. 155 shows the base with added area constructed for the same patient. Fig. 156 shows an original base, and Fig. 157 shows the area of a base constructed later to replace it.

**Full-base Dentures More Acceptable Than "Roofless Plates."**—"Roofless plates" may be successfully constructed for mouths which have large areas and which possess tissues medium soft at least and in healthy condition. But any degree of success with these will be greatly multiplied in the use of a full-base denture. Except in the case of a patient obsessed with the ineradicable idea that she is unable to tolerate anything over the vault, there is no instance in which a full-base metal base denture is not more desirable.

## PERIPHERAL ADAPTATION

In using this expression—peripheral adaptation—the author refers to the adaptation along the inner surface of the denture near the

buccal and labial flanges and along the posterior border, and it signifies that the adaptation here is closer and that the compression of the tissues is greater than along other surfaces of the denture. The advantages to be gained from a close peripheral adaptation are the ones most likely to be neglected in the process of impression-taking, and yet no contribution to successful retention is more essential. The degree to which the borders of the denture are adapted to the

Fig. 158.—A plaster impression taken without regard to distended tissues. The kind, however, that "sticks," although the denture constructed with its use possesses practically no retention.

tissues affects directly the degree of atmospheric pressure that will be available.

**Effect of Atmospheric Pressure May Be Mistaken for Evidence of Close Adaptation.**—It is easy for the modeling compound enthusiast to confuse atmospheric pressure in its effect as a primary force in retention, with adaptation. In securing his impression the dentist using modeling compound often creates a large but very shallow

vacuum chamber through pressing the compound firmly into position. The lips and cheeks falling over the labial and buccal borders, prevent an ingress of air in these regions, while along the posterior border the impression material slightly imbedded in the soft tissues secures the same result. In order that atmospheric pressure may operate as a significant factor, a vacuum must be created. With the vacuum thus created by means of the impression material against the tissues the operation of atmospheric pressure is made so effective that it is with difficulty that the impression may be dislodged. The dentist often erroneously regards the effect as due to splendid adaptation, and both he and his patient are deceived by this "test-impression" into unwarranted expectations regarding the finished denture.

**A Vacuum Cannot Be Maintained.**—Even if it were possible for the dentist to incorporate in the construction of the denture a provision for creating a similar vacuum in the patient's mouth, it is not desirable because it cannot be maintained. The tissues of the mouth will not tolerate it, and while the patient may be delighted for a few days and may give the dentist full credit and responsibility for the "success," he will naturally expect the dentist to bear the burden of such "success" when the tissues have filled the vacuum, and thus destroyed the "adaptation." The author is not an anticompound technician; he believes that an expert operator may secure final results with compound impression-taking, which equal those obtained by a plaster enthusiast. But he is convinced that, owing to the ease with which compound may deceive the operator, the patient, and the audience, the novice will show himself wise in employing a method which does not permit this unconscious self-deception.

**Innumerable Vacuum Cups May Be Produced with Improper Use of Plaster.**—A similar obsession possesses a dentist who improperly employs plaster. After filling a metal tray with plaster and pressing it in mushy condition against the vault of the mouth, distending the tissues and filling every available portion of the oral cavity above the lip line (Figs. 158 and 159), such an operator often stands out with pride and congratulates himself because of the difficulty confronting him, when he attempts to remove the mass from the mouth. Atmospheric pressure is operative. Innumerable minute vacuum cups are produced in the plaster through the setting of the mixture; the moisture of the tissues responds to the affinity of the plaster for moisture and often the leeching effect results in an impression covered with blood.

**Simplicity of Wilson Method of Securing Peripheral Adaptation.**—The simplest method of securing peripheral adaptation known to the author is that which was employed by Dr. Geo. H. Wilson. Following his method, the operator lines with beeswax the borders of a metal tray. The massaging of the cheeks as indicated in the Greene method is for the same purpose, but this method requires a very skillful employment of compound at a proper temperature which is determined through a rather extended experience. The author follows the principle according to which Wilson secured peripheral adaptation. However, the author has found that the construction of an individual impression tray of black compound, together with the employment of black carding wax, gives the most satisfactory results, and for the novice is the most easily mastered. The technic is given in Chapter I.

Fig. 159.—A well constructed cast of the same mouth was placed in the impression shown in Fig. 158. This section of it discloses the degree of improper distention of tissue. The light area indicates the cast; lined area indicates section of impression; shaded area shows space where adaptation of the finished denture will be lacking.

## EXTENSION UPON THE SOFT TISSUES

**Base of Denture Should Be Extended Posteriorly Farther Than Necessary.**—Because of the importance of area in an endeavor to secure the best possible retention of a denture, the author recommends in many instances the extension of the base at the palatal border farther than the operator judges that it can be worn by the patient. Whenever it is demonstrated that it impinges unduly upon the tissues, the operator may easily trim away the offending portion. If this trimming is done very sparingly and yet very willingly each time the patient returns, there will often be added more than ten millimeters to the length of a base which the patient thought at first was already as long as could be borne. That is, the new denture may be extended that much farther than the old one which the patient has been wearing. Ordinarily, dentists seem to be very fearful about extending the

base sufficiently to take full advantage of the area to be gained and of the peripheral seal guaranteed through this extension. In every instance the base should extend back of the posterior margin of the palatal bones. Consequent upon this effort to extend the base to the end of the palatal bones, the posterior border of the base may often resemble a cupid's bow instead of following a straight line or one continuous curve. Note posterior border of the bases shown in Figs. 155 and 157. This is not only permissible, but is necessary in mouths in which the soft tissue on either side tends to become easily irritated.

In a case in which a patient will not accommodate himself to an extended base as ordinarily constructed and it is necessary to shorten it more than the operator desires, it is advisable to turn up the extended portion sufficiently to keep it imbedded in the soft tissues. When this is turned up, the edge, of course, may not be left sharp, but often will be a millimeter and a half in thickness. An extended base will not need to be deeply imbedded, nor will the tissues tolerate it.

**Special Condition under Which Atmospheric Pressure Is of Special Importance to the Prosthetist.**—This extension is for the purpose of taking full advantage of the forces both of adhesion and of atmospheric pressure. Previously in this chapter it was observed that atmospheric pressure had no special significance except under a special condition. This condition is that in which a vacuum is involved. In the act of mastication the denture is retained by adhesion and leverage; when the leverage exerted against the anterior portion of the denture tends to displace the denture, the soft tissue along the palatal border adheres tenaciously and follows the base downward after the fashion of the sides of a bellows opening with the intake of air. However, in the case of the denture, instead of air entering, a vacuum is created through the rarefying of the air enclosed within the borders of the base. With the periphery sealed, the vacuum is maintained and atmospheric pressure becomes operative as a primary force in retaining the denture.

**Adhesion and Atmospheric Pressure May Alternate Continuously During Mastication.**—The phase of retention in which the force of adhesion is the primary factor and the phase in which atmospheric pressure is the chief factor, may follow each other continuously during the acts of mastication; but the range of displacement and return to position may be so slight that the transition is usually imperceptible to the patient, and consequently occurs without annoyance or inconvenience.

## MUSCULAR CONTROL

**Force of Friction Aids Retention.**—Patients wearing very ill-fitting dentures have often utilized a force for retention which wearers of properly constructed dentures avail themselves of but little—and consciously in many instances not at all. They are able to supply through muscular manipulation a force which presses the denture against the ridge and by a kind of friction retains the denture more securely. This force is perhaps more in evidence when a patient fails to exercise it temporarily after employing it habitually in retaining his denture; then, just a slight relaxation of the tension allows the maxillary denture to fall.

## LEVERAGE

**"Mech-anatomical" Occlusion Better Than Anatomical.**—Anatomical occlusion as an ideal for artificial dentures is, strictly speaking, a misnomer with reference to the occlusion desired. Artificial teeth, if placed upon the bases in positions corresponding to the exact anatomical positions of the natural teeth, would in the maxilla be placed too far outside the ridge, while those of the mandible would be too far inside the ridge, due to the fact that after the teeth have been removed, the alveolar process of the maxilla resorbs upward and inward, while that of the mandible resorbs down and outward. The occlusion desired is not an exact anatomical reproduction of alignment, but rather a mechanical arrangement which will serve as an anatomical substitute —a "mech-anatomical" occlusion, if the expression is acceptable. This requires that the teeth of the maxilla be inclined outward and those of the mandible inward, so that a line drawn through the long axes of the occluding bicuspids and molars will pass through the crests of both ridges.

**Posterior Teeth Are Set upon the Ridge So That the Force of Mastication Will Tend to Stabilize the Dentures.**—As explained in Chapter I, it is desirable to set the posterior teeth so that the force of mastication will pass through the crests of both ridges. This is because of the fact that ordinarily this method of setting the teeth stabilizes the dentures; force exerted against a tooth upon the crest of the ridge will thus press the denture against the ridge and increase the retention. In the case of a denture whose base has been extended to include a great deal of tissue that is not truly a part of the ridge, the teeth may not be set upon the crest of the ridge. However, this will not be a deviation from the principle according to which posterior teeth

should be set upon the ridge. The direction of the force of mastication, exerted through an extended base will be through a portion of the ridge other than the normal crest. It will be less confusing, perhaps, if no reference is made to "crest." Then we may say, that the posterior teeth on either ridge are set in such manner that the force of mastication where exerted against the teeth will tend to press the denture more firmly against the base upon which it rests.

**Consideration of Leverage in Balancing Occlusion and in Direction of Masticatory Force.**—With reference to the leverage involved in mastication, two phases should be distinguished, namely, one which is primarily concerned with the direction of the force exerted by the muscles in moving the mandible, and one which has to do with retaining the denture by balancing the occlusion. In the latter phase, one portion of the denture may be regarded as acting as the power arm of a lever and another portion of the denture as serving as the work arm. This is especially true, when the anterior teeth bite something in such manner that the posterior palatal border of the denture is drawn away from the vault. For example, in biting an apple, the palatal portion of the maxillary denture may be considered as the power arm, the alveolar ridges as the fulcrum, and the incisal edges of the anterior teeth as the work arm.

**The Mandible as a Lever of the Second Class Excludes the Condyles as Fulcra.**—Formerly in the consideration of the leverage involved in mastication, dentists regarded the mandible as a lever of the third class. That is to say, the condyles were regarded as fulcra. The author believes it is generally accepted by prosthetists as established by anatomical facts that the mandible is not a lever of the third class. In fact, Dr. Walter J. Pryor, of Cleveland, Ohio, has constructed full maxillary and mandibular dentures for a patient who had lost a piece of the zygoma and also the entire condyle and part of the neck of both sides of the mandible, and reports that after a year they seem to be a perfect success. The mandible, as now regarded, finds its fulcra in the anterior portion of the mandible, and its power arms extending from the points of attachment of the muscles of mastication posteriorly to the condyles.

**Proofs for This Conception of the Mandibular Leverage.**—Dr. George Henry Wilson has probably done more than any other prosthetist to emphasize the above reversal in conception of mandibular leverage. Among the proofs which he submits in substantiating this reversal are the following: "Its (the masseter muscle) origin is along the entire border of the zygomatic process. The muscle passes down-

ward, inward and backward and is inserted into the outer surface and angle of the ramus of the mandible. Therefore its power (power of the superficial portion of the masseter muscle) is to draw the angle and ramus upward, forward and outward; and every part of the mandible must move in the same direction obviously." * * * The internal pterygoid muscle has its origin "upon the inner surface of the internal pterygoid process and from the greater wing of the

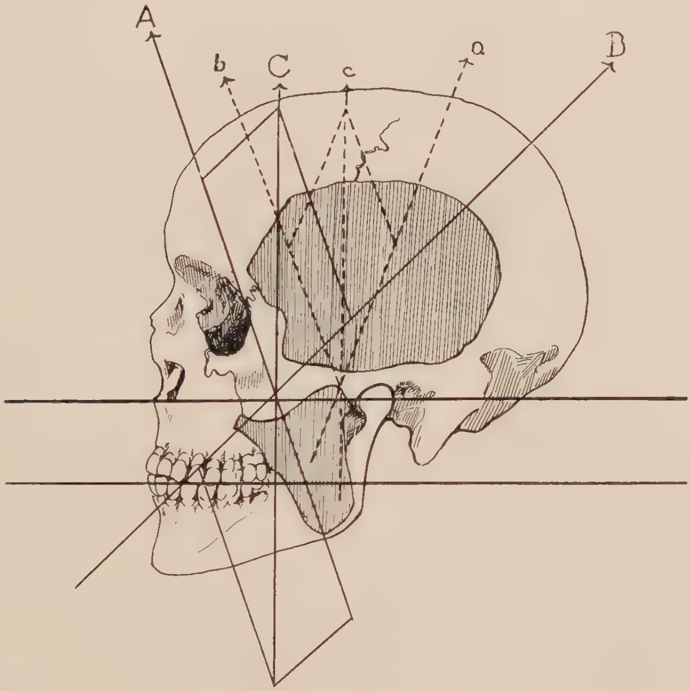



Fig. 160.—Parallelogram of forces as applied to muscles of mastication. (After Wilson.)

*A*, Direction of force exerted by the superficial portion of the masseter and by the internal pterygoid muscles; *a*, direction of force exerted by the deep portion of the masseter muscle; *B*, direction of force exerted by the posterior portion of the temporal muscle; *b*, direction of force exerted by the anterior portion of the temporal muscle; *C* and *c*, indicate direction of resultant forces, that is, the force follows the diagonals of the parallelograms and is exerted in line with the long axes of the teeth. Of course, these directions are suggestive, not absolute. The conception of the masticatory mechanism as a mill is given elsewhere.

sphenoid process passing downward, backward and outward to the inner surface of the ramus of the mandible. The action of this muscle is to draw the mandible upward, forward and inward. The masseter and internal pterygoid acting coordinately will draw the mandible directly upward and forward. * * * The temporal muscle arises from all over the temporal fossa of the temporal bone and is inserted

into the coronoid process. The direction of the force of the posterior portion of this muscle is upward and backward. Therefore, when the three forces are coordinated their resultant action is in a vertical direction in the proximity of the first and second molars. This is demonstrated by the parallelogram of forces (Fig. 160). Because of this coordination of these three forces, a bolus of food can be placed between the molars and all of the power of these three coordinate muscles will be expended upon the food and none of it upon the condyle. Therefore the mandible is not a lever of the third class.''

Fig. 161.—Efficiency dentures. The posterior teeth are provided in blocks and carved to a wedge and groove relationship.

**Mandible Involves a Suspended Lever of First Class; But Ordinarily Operates as Lever of Second Class.**—''The mandible involves a suspended lever of the first class; the ligaments described and the stabilizing action of the masseter and internal pterygoid act to form a fulcrum in the proximity of the two stabilizing muscles, the ramus terminating in the coronoid process is the power arm, the temporal muscle is the power, and the body of the mandible constitutes the work arm.''

* * *

**Operating as a Lever of Third Class Is Not Normal.**—''Remember! That when the condyle becomes a fulcrum of the third class, it is not the intent of Nature; that it is not normal; that it is abnormal, and

that a pathological sequence is installed." ("The Fundamental Principles of Artificial Denture Construction." By Geo. H. Wilson, D.D.S., Cleveland, Ohio. *Dental Cosmos*, July, 1921.)

Dr. Wilson has also suggested that the masticatory mechanism of the human anatomy may be regarded as a mill. By inverting a skull it may be easily presented as a form of mill in which the mandible thus inverted serves as the upper millstone. Such a presentation tends to dispose of erroneous views regarding the function of the ligaments; they are now seen to be concerned only with preventing the mandible from going beyond bounds.

**Available Leverage for Retention Is Sometimes Sacrificed for Esthetics.**—As already pointed out, retention is increased through the leverage gained in setting the teeth properly upon the ridge with

Fig. 162.—Another view of efficiency dentures.

reference to the stress which is exerted during the course of mastication. However, this advantage is not always available because of the fact that esthetic demands sometimes conflict with the demands for the best possible retention. If it were possible to set the teeth of the mandible inside of the crest of the ridge, there would be no possibility of the denture tipping. The tongue precludes this, because the space demanded to accommodate it precludes the physical advantage of such an arrangement.

**Esthetics May Be Sacrificed for Masticatory Efficiency.**—It is sometimes desirable for a patient to have efficiency dentures in addition to those which are regarded by him as more adequately fulfilling his esthetic requirements. Figs. 161 and 162 show efficiency dentures constructed for the patient shown in Fig. 163. In addition to the fact that these efficiency teeth permit the operator to set them more nearly upon the crest of the ridge, the molars and bicuspids of the

maxillary denture are manufactured in one block; the molars and bicuspids of the mandibular denture are also made in block form. As manufactured, these maxillary teeth have their buccal and lingual triangular and marginal ridges planed down to their central fossae; the resulting plane of the buccal surface is provided with serrations as shown in Fig. 161. The teeth of the mandibular block have the wedge-shaped form and thus provide, with the maxillary teeth, a typical wedge and groove relationship, with the consequent shearing efficiency. The author is indebted to Dr. Victor H. Sears of Salt Lake City, Utah, for these teeth. They may be made from the blocks

Fig. 163.—Patient wearing efficiency dentures; compare esthetic effect with Fig. 113-*B*.

of posterior teeth which are manufactured by the Dentists' Supply Company of New York City.

**New Conception of Mandibular Leverage Confirmed by Dr. Prentiss.**—Further corroboration of the correctness of this new conception of mandibular leverage is presented in the *Dental Cosmos,* June, 1918. An article by H. J. Prentiss, M. D., Professor of Anatomy, at the University of Iowa is based entirely upon laboratory investigations of various joints, and after considering the histology of the knee joint from stages of the early embryo to those of adult life, he observes: "We see therefore in the knee joint a retrograde absorption of the meniscus (articular disk) which is necessary to a normal

function of the joint. The sequence of events just followed in this joint (knee) may be traced to the mandibular joint, only here it becomes pathological with the loss of the teeth." Thus his findings tend to confirm Wilson's statement that when the condyle becomes a fulcrum of the third class (as a result of the loss of the teeth) a pathological sequence is installed, namely, the destruction of the meniscus.

## FORCE OF GRAVITY

**Gravity or Weight, Scarcely Affects Denture Construction.**—The term *gravity* is applied to the mutual attraction which exists between the earth and a body upon or near its surface. The measure of this attraction is the *weight* of the body.

Full denture prosthesis is very little concerned with this physical force. Since the maxilla has developed no sense of weight, no weight of a denture made of any material is perceptible to it. Patients often hold a metal base denture in their hands and express fear that its weight will prove tiresome, but their fears are groundless. Only in case the weight should be so great as to tire the muscles of the neck—of course, not possible in denture construction—would it be objectionable. If the weight were such as to destroy adhesion and overcome the force of atmospheric pressure, the prosthetist might be warned against this factor; but with the materials now used, and with a recognition of the demands of the anatomical structures of the oral cavity, there is no likelihood of danger from this source.

**Weight of Mandibular Denture Has Comparatively No Significance in Retention.**—The mandible has a sense of weight and it is possible to construct a base of Watt's metal or Weston's metal that is too heavy to be worn without tiring the muscles. An attempt to aid retention through adding weight to the mandibular denture is prompted by fallacious reasoning or an incomplete survey of the facts. As a positive factor in retention, weight has no significance in comparison with other physical factors already enumerated. Several years ago the late Dr. L. P. Haskell demonstrated in his own mouth, that the tongue possesses sufficient strength to displace any mandibular denture regardless of weight; he also called attention to the undesirable character of a weighted mandibular denture because of the annoyance resulting from its displacement while the patient is asleep or in a recumbent position.

Usually in a denture in which weight is thought to have a stabilizing influence, area, together with buccal and labial adaptation are really the important factors.

## CHAPTER VII

## IMPRESSION-TAKING

**An Impression of the Exact Condition of Tissues Is Not Desired.**—In taking an impression for the purpose of constructing a full denture, the prosthetist does not try to obtain an impression of the exact condition of the tissues. He does not seek such an impression as is indispensable to the die-sinker in making a die for coins. The moulder in the foundry endeavors to mould a form which poured with metal will reproduce as exactly as possible the original article or pattern. The prosthetist has a different purpose. He seeks an impression of mouth conditions such as will serve most advantageously in the construction and retention of the most efficient denture. For example, he may seek an impression of tissues, not as they are when there is no denture in the mouth, but an impression of these tissues when they are compressed sufficiently to bear the stress of mastication. Allowance must be made for other tissues which change their shape or position under masticatory stress or in facial expression. It may be necessary also to design the impression in such fashion as to effect changes in facial contour; in this case it is thoroughly obvious that at no stage in the construction of the denture is it desirable to obtain in the impression a copy of actual conditions.

**The Ideal Denture.**—The ideal denture is worn by the patient with (1) comfort, (2) masticatory efficiency, (3) pleasing esthetic effect, and (4) without harmful effect upon the tissues. The prosthetist endeavors to provide these qualities, each in the maximum degree. Occasionally, a patient will insist that one of these qualities must be provided, without very much regard for the others. In the case of such insistence, the prosthetist will probably conform his plan of construction to suit, unless this tends to degrade his workmanship or result in a product of which he will be ashamed.

**Desirable Characteristics of an Impression.** The impression sought by the prosthetist with a view to constructing the ideal maxillary denture will (1) cover as extensive mouth area as possible, (2) be closely adapted along its peripheral border, (3) extend posteriorly upon the soft portion of the palate, (4) indicate correct facial contour, (5) and equalize pressure which may properly be brought to bear upon any portion of the finished denture.

**Undesirable Characteristics.**—In endeavoring to secure the advantages to be derived from an impression of the kind just described, the prosthetist should avoid: (1) encroachment upon muscles, tissues, or attachments which will tend to displace the denture or render it uncomfortable, (2) injurious effect upon tissues through inhibiting the nerve or blood supply, (3) displeasing esthetic result.

**First Requisite.**—The advantage to be derived, through covering with the base of the denture as much of the ridge and of the surrounding tissue as the case will permit, is based upon the laws of physics. This extension in area increases the force of adhesion and also the force of atmospheric pressure; both of these forces increase in direct ratio to the increase in area of the base. The advantage thus derived is purely and wholly physical and is discussed more at length in Chapter VI. Enough has probably been presented to emphasize the fact that a patient with a large mouth may properly expect better denture retention than a patient with a small mouth. This is true, if other conditions are as favorable in one case as in the other. Accordingly, the operator will be especially careful in securing area in the case of small mouths, although in no case is he justified in neglecting this important factor. He might secure fairly satisfactory results in a denture for a large mouth, without giving any thought during impression-taking to the matter of area. The same kind of attention or lack of attention would almost certainly be unsatisfactory for a patient whose ridges and surrounding tissue permit at best the covering of a comparatively small area.

**Peripheral Adaptation Is Second in Importance.** In the order of importance so far as retention is concerned, peripheral adaptation follows extent of area covered. While the posterior border of the palatal portion of the impression is properly a portion of the periphery, it is not usually under consideration when "peripheral adaptation" is being considered. The palatal portion at its posterior border is discussed under "post-damming." The portion of the periphery which the operator seeks to adapt very closely may be described or outlined by a line extending on each side from the posterior buccal border to the labial frenum. The line indicated is placed two or three millimeters below the crest of the border. Some of the older practitioners formerly were accustomed to scrape the cast in this region, in their endeavor to secure the adaptation desired. This scraping method has always seemed to the writer to involve a large measure of guesswork; at any rate, he believes the method, which employs a wax wire at

body temperature in securing the desired contact with the tissues under pressure, is more certain and uniformly satisfactory.

**Extension on the Soft Portion of Palate.**—That the impression should result in a denture which according to the desired characteristic numbered (3) above will "extend posteriorly upon the soft portion of the palate," emphasizes the importance to retention which close adaptation along the posterior palatal border will provide. This extension for the purpose of covering soft tissue is important because, unless the border of the denture is slightly imbedded in the tissue at every point in the periphery, the denture is not sealed in such effective manner as to be air-tight. Unless the border is thus sealed, the force of atmospheric pressure will be lost. Ordinarily, there is no difficulty in securing this "valve-seal" at every point, except across the posterior border of the palatal portion. The problem which confronts the operator in securing a desirable impression of the tissue at the posterior border, is due to the character of this tissue. If the impression stops short upon the hard, tense tissue of the vault or palate, the desired seal will be lacking. If the impression extends too far upon the soft portion of the palate, the denture will be uncomfortable and probably interfere with the patient's speech. Of course, proper extension at every point is desirable in securing larger area. The problem is to secure sufficient *compression* of the soft tissue at the junction of the hard and soft portions of the palate without undue *depression* of the soft portion. This requires skill and is perhaps as difficult as it is desirable. Again, the writer recommends the use of the black carding wax which, softened to body temperature, almost automatically registers the desired degree of compression. The technic employed in its use is discussed in connection with "post-damming"; this is the term which has long been used to designate the operation designed to secure the desired impression along the posterior border of the palate.

**Providing Facial Contour.**—In taking an impression for a patient whose facial contour requires to be built out so as to restore or provide characteristic facial expression, the prosthetist will often find that it is impossible to do this without constructing a series of dentures. Accordingly, each impression should be built out in the cuspid regions as much as the prosthetist judges the lips and cheeks will tolerate. Of course, the *denture* may be sand-papered to remove a portion, wherever, because of the bulk, the tension of the tissues constantly tends to displace it; but, this tension, just as that which results from setting the six anterior teeth labially with reference to the ridge, will

gradually relax after the denture has been worn for some time. Then, if necessary, a new impression may be taken and a new denture constructed to build out the contour more as desired.

**No Pressure on Vault Until Tissues of Ridges Yield.**—The impression should be seated in the vault in such manner that the pressure, which will be exerted at this point when the finished denture is being worn, is not exerted here until after pressure is brought to bear upon the ridges. As the tissue of the ridges yields beneath the denture, the pressure then should come to bear upon the vault.

**Proper Material Is Valuable.**—Undue encroachment upon tissues which in ordinary habitual movements tend to displace the denture, of course must be avoided. While a knowledge of the anatomical structure of the ridges, vault, and adjacent tissues will be helpful in securing an impression which avoids this undesirable encroachment, the use of a material which yields at points of encroachment during the impression-taking process tends to secure the desired result in a way which is akin to automatic.

The operator should be aware also of the location of the nerve and blood supply so that undue pressure may not result in pain or deterioration of tissues. The use of plaster in taking the final impression makes it nearly impossible with a properly constructed individual compound impression tray to secure an impression which is undesirable in this respect.

**Fundamental Principles Are of First Importance.**—Throughout the chapters of this book, the author endeavors to emphasize the fact that a mastery of the fundamental principles of full denture prosthesis is of first importance. Thus far, in this chapter, an effort has been made to present briefly the objects which the prosthetist should seek in impression-taking; as a corollary to seeking those objects, attention has been called to certain results or tendencies which should be avoided. With these desirable objects in view and conscious of harmful tendencies which shall be avoided, the prosthetist may employ such materials and such technic as will best serve this purpose. Usually there will be sufficient variations in different individuals to make it unlikely that all will be equally effective in the employment of the same materials or technic.

**Combination Method of Taking Impressions.**—The author has found it advisable to avail himself of phases of the three outstanding technics in impression-taking, which are the Greene, the Wilson, and the Hall technics. Sometimes he finds it necessary to stress one of these phases, and sometimes conditions make attention to another phase

more important. Incidentally, it may be observed that for the purpose of demonstrating the principles involved, the instructor will find that he will be more effective through availing himself of phases of each rather than through adopting an exclusive technic. Beginners more easily tend to focus their attention upon the principles involved, if they are permitted to choose materials and methods. Of course, an expert in the exclusive use of a single technic will get expert results. In the development of experts, and in the achievement of uniformly better results during the course of developing experts, this eclectic or combination method of impression-taking appeals very strongly to the author. He employs it in his own practice, teaches it to students and presents it in this textbook as logically, pedagogically, psychologically and by pragmatic test worthy of superior regard.

**Hall's Method of Making Individual Compound Tray.**—According to this method, an individual impression tray is formed for each impression. This is done largely after the method suggested by Rupert E. Hall, now of Chicago, Illinois, and with the use of black impression tray material which is manufactured by S. S. White after a formula provided by Hall. Detailed technic is supplied in Chapter I.

**Greene's Method Modified for Adapting Borders.**—It might be possible for an expert to make the impression wholly of this material, but the author finds it much more easily made in part with the use of Kerr's stick modeling compound and with the aid of the technic which J. W. Greene outlined many years ago. The Kerr's compound softens at a lower temperature than the Hall's and thus becomes pliable and impressionable at a temperature which leaves the supporting Hall's compound rigid and unyielding. Thus, the main body of the individual impression tray remains unchanged while the border is more closely adapted by means of the softer (Kerr's) compound. According to Greene's technic, the height of the border of the tray as well as avoidance of muscle and tissue encroachment, were secured with the assistance of the patient. The patient was instructed to move the lips and cheeks in grimaces and contortions that caused the softened compound to yield wherever the tissues impinged upon it. The author prefers to depart from the instructions which Greene was accustomed to give his patients; the departure is on account of psychological reasons which are discussed more fully in the chapter entitled "Psychological Phases of Full Denture Prosthesis." The only assistance of this sort desired by the author is limited to the movement of the patient's tongue to rest on the upper lip during the

process of taking an impression of the mandibular ridge and adjacent tissues.

While the detailed technic of impression-taking is given in Chapter I, attention may here be called to the fact that even in the case of a patient whose facial contour requires the addition of compound in the cuspid regions, the Hall compound tray may be trimmed just the same as if facial contour were not under consideration; the desired contour may be supplied by means of the Kerr's stick compound adapted by massaging the lips as indicated.

**Wilson's Method of Compressing Soft Tissues.**—The height of the border of the impression, and its outline in harmony with muscles and tissues is secured, as has been suggested, by means of the Hall compound impression tray and the Kerr's stick compound, with the use of a modified Greene technic. Compression of the soft tissues is obtained through the employment of black carding wax with a modified Wilson technic. Compression of the soft tissues usually has been a bugaboo to the dentist, because of the difficulty of determining for this purpose the proper temperature of the Kerr's modeling compound. If the compound is too warm, it flattens out without compressing the tissues; if it is not warm enough, the compound rides upon the harder tissues and leaves the areas to be compressed practically unaffected. Instead of using beeswax as George H. Wilson was accustomed to do in lining the Britannia metal tray, the author prefers to use in connection with the individual black compound impression tray a softer material than beeswax, namely, the black wax upon which the teeth are carded by the manufacturers.

**Final Impression with Plaster.**—After the individual impression tray has thus been prepared, the final impression is taken with plaster. The tray as thus prepared has secured the desired compression of certain tissues, has made allowance for the impingement of certain others, and has distributed the bearing of pressure in such manner that it will be equalized under the stress of mastication. Plaster is now used in order to secure contact with other tissue, especially that of the palatal area where there must not be any undue pressure. If the technic of Chapter I is followed, undue pressure cannot be exerted, because the black compound of the individual impression tray has been left at a point in the median line some three centimeters anterior to the post-dammed palatal portion in order to prevent it. The plaster is too thin to exert undue pressure and furthermore the hole in the tray permits its escape as pressure is brought against it. In addition to the precaution taken to avoid undue pressure during the taking

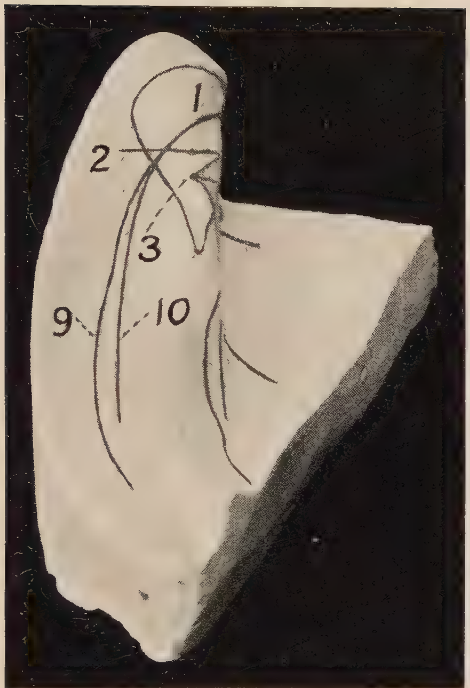
of the impression, a relief is provided *on the cast* in order to assure comfort and stabilization of the denture so far as the area over the raphe is concerned.

**Combination Method Provides for Various Conditions.**—The author believes that the combination method of impression-taking makes it unnecessary to offer special technics for varying conditions in mouths. Flat vaults, deep vaults, medium vaults; hard, tense tissues, medium, soft tissues and tissues that are soft and flabby; ordinary raphe and enlarged raphe are all provided for. The operator needs only to keep in mind as he deals with the various conditions that he is seeking to distribute the force of mastication over as large area as possible and at the same time avoid undue pressure or encroachment where it cannot be tolerated. The use of the materials suggested, with the technic as outlined, admits wide variations. The operator is at liberty to modify the outlined technic, wherever his individual style of manipulation requires a modification in order to obtain an impression possessing in maximum degree the characteristics which contribute to the construction of an ideal denture.

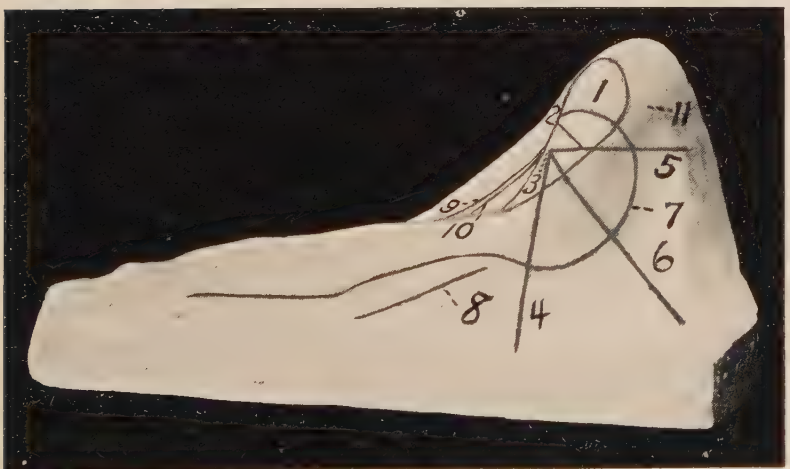
Because of the erroneous idea that flat vaults are difficult if not impossible to supply with satisfactory dentures, it may be worth while to say that the modern prosthetist does not regard flat vaults *as such*, as more or less difficult than others. That flat vaults may retain dentures more effectively than any others is discussed in Chapter VI under the heading of "Physical Factors."

**Ropy Saliva.**—In taking impressions of a mouth which has thick, ropy saliva, the operator should furnish the patient with a solution of diluted muriatic acid (three drops of acid to eight ounces of water) and request him to rinse the mouth until the secretion is of a watery character. Any good astringent will serve this purpose. The thin saliva permits closer contact between the impression material and the tissues.

**The "Retroalveolar Fossa" in Mandibular Impressions.** In the *Dental Summary* of October, 1922, Bowen K. Bowen of Nashville, Tennessee, describes an area of the mandible which he terms the "retroalveolar fossa." This particular area, unnamed in textbooks on anatomy, has heretofore received no special attention in the taking of mandibular impressions. "A close study of the inner surface of the mandible reveals the mylohyoid ridge running obliquely upward and backward from a point under the apex of the bicuspid tooth to the alveolar border opposite the third molar. The mylohyoid muscle is attached to this ridge throughout its entire length, and with its




A.




B.

Fig. 164.—Casts with drawing to show area to be incorporated in the denture.

*A.*—Anterior View. *(1)* Pear-shaped area outlining retromolar triangle. *(2)* Line bisecting this area. *(3)* Point three millimeters anterior to line *2*. *(9)* Approximate location of buccinator muscle attachment. *(10)* Buccal margin of denture area.

*B.*—Lingual View. *(4)* Line perpendicular to occlusal surface and passing through point *3*. *(5)* Line parallel with occlusal surface and passing through point *3 (A)*. Line bisecting angle formed by lines *4* and *5*. (7) Curved line passing through deepest point in curved lines *4*, *5*, and *6* when cast is held in perpendicular. (8) Approximate position of mylohyoid ridge and muscle. *(11)* Approximate insertion of pterygomandibular ligament. (Neil.)

fellow of the opposite side, forms the floor of the mouth. Above and behind the extreme distal end of this ridge we have the superior constrictor of the pharynx and the pterygomandibular ligament attached to the inner surface of the ramus. Between these two points, viz., both the distal end of the mylohyoid ridge and the attachment of the pterygomandibular ligament and the superior constrictor of the pharynx, we have an area covered with mucous membrane that will tolerate the presence of a plate extension (Fig. 164).

Fig. 165.—Bowen tray, showing the hinged flanges.

"A further study of the inner surface of the mandible reveals that the crest of the alveolar ridge is well within the internal oblique line of the anterior margin of the ramus. At the extreme distal end of the mylohyoid ridge the inner surface of the mandible turns sharply away from the sagittal plane. This gives us an undercut into which the plate extension is carried. This area forms an opposing undercut with its fellow of the opposite side."

Fig. 165 shows one of the Bowen trays for securing an impression which includes this area. It is one of a series of seven (American Dental Specialty Co., Nashville, Tenn.); one of these is selected, de-

pending upon the size of the ridge and the angle which this area makes with the ridge.

**Bowen-Neil Technic.**—Ewell Neil, Dental Department of the University of Tennessee, Memphis, in conjunction with Bowen, has evolved a method of securing this impression. "Nebo" impression compound, which contains more resin than most other compounds, softens more easily and also fractures with a clean fracture, is put into the tray and pressed into position upon the ridge; it is then chilled with ice water and removed from the mouth. The tray is then separated by releasing the screw and inserting a knife between the halves. This divides the compound into two sections, which after removal from the tray are reassembled in it; the hinged portions

Fig. 166.—Dentures constructed according to the Bowen-Neil technic; practical cases.

of the tray together with the compound are dipped into hot water and then shaped with the fingers so that when again inserted into the patient's mouth, the wings may be pressed into the retroalveolar area. The tray is seated upon the ridge and held down firmly with the portions of the index fingers nearest the palms of the hands, while the tips of these fingers press the wings of the tray against the area mentioned. The operator maintains pressure in this manner until the assistant has chilled the compound thoroughly with ice water. The screw is again released and the tray with the compound removed in two sections.

**Closer Adaptation Is Secured Through Using Finished Denture for Final Impression.**—A cast is poured with plaster of Paris, since accuracy at this stage is not vital; the case is then completed in the usual manner. After the denture is finished, the intaglio of the base is cut

out with a bur used in vulcanite work, until it is entirely renewed in order that the rubber subsequently added may be closely united when the case is again vulcanized. This surface is supplied with Kerr's modeling compound and evenly heated with the chip-blower or blow-pipe, tempered in hot water, and then placed in the patient's mouth. The patient is instructed to close and hold in this position until the compound is chilled with ice water. This use of the compound is repeated until the impression is satisfactory. The case is then invested in the lower part of a flask with Austin's synthetic stone or with one of the other materials of this quality; when hardened, the flanges of the dentures are then cut away and these portions supplied with wax to facilitate separation of the portions of the flask. The method described in Chapter XVI is followed from this point to completion. Fig. 166 shows dentures constructed for patients.

The method is too new for the author to express an intelligent opinion as to its possibilities. The advantages of increased area and of such a mechanical aid to mandibular retention are obvious enough to assure study and experimentation sufficient to disclose the extent of its availability.

# CHAPTER VIII

## CASTS

**Definition.**—A cast is something that has been cast (*kasta* = to throw), or thrown, or poured, or run, into a mould, out of plastic material. The jaws are the dentist's models which he reproduces in the casts. Since the cast is not reproduced and since it is usually a negative form to the finished product of our efforts, we are not justified in calling it a model. Owing to the persistent confusion resulting from the indifferent use of "model" and "cast," the writer believes that the dental profession would profit by discarding for a few years the word "model" from its prosthetic vocabulary. It is true that the wax denture ready to flask is properly a model, and that the dentist endeavors to reproduce (excepting the teeth) this wax model in vulcanite or in vulcanite and metal. However, instead of "model," the word "pattern" might properly be used in this instance.

**Wilson Explains Origin of the Confusion.**—Historically, to quote from Wilson's Dental Prosthetics, 1920, page 137, "It is interesting to note the origin of this use (in both a positive and a negative sense) of the term *model* in dentistry. At the time of the introduction of vulcanite, during the fifties of the last century, plaster models were in constant use for constructing dies for metal base-plates. As vulcanite work is constructed upon the plaster form in place of a metal form, it was only natural that the familiar term *model* should be retained for the new use. Unfortunately, the teachers and writers of textbooks at the time of the introduction of vulcanite did not give sufficient thought to the philology of the glossary required for the new art; hence some of the terms that have come down, even to this day, are not scientific."

**Use of Plaster of Paris in Making Casts Is Condemned.**—A cast intended for use in the actual process of constructing an artificial denture should never be made of plaster of Paris. The one excuse that may be offered for its use, is inexcusable, namely, that the use of plaster in making a cast saves time. Considering the losses and failures that must be attributed directly and indirectly to the use of this material, the possibility that some time may be saved in the

initial stages is not sufficient justification. This material does not maintain its integrity during packing and vulcanizing. Its qualities of expansion, contraction, and compressibility, make the results consequent upon the use of plaster very uncertain, and prevent the careful operator from risking the outcome of his efforts upon this treacherous material.

**Artificial Stone Compounds Make Far Superior Casts.**—Some years ago it might have been permissible to use plaster of Paris in making casts, because the several more satisfactory artificial stone compounds had not been placed upon the market. Today it is easy to select from a number of these. The writer has found Spence's plaster compound most suitable for casts when vulcanite or aluminum bases are being constructed. This compound produced by Stewart J. Spence of Chattanooga, Tenn., has four times the strength of plaster of Paris and is almost entirely lacking in the property of expansion. Until recently, the writer was unacquainted with a compound which compared closely with it in time required in setting, hardness and smoothness of resulting cast, method of manipulating, and cost per pound. Austin's Synthetic Stone produced by J. L. Austin and marketed by the Austin Mfg. Co., of Chattanooga, is almost identically the same as Spence's plaster compound.

**Healey's Artificial Stone Is Used in Swedging Gold Bases.**—In the construction of cast aluminum bases, either Spence's or Austin's material provides a cast sufficiently hard for swedging purposes. A harder cast is required in the course of swedging cast gold bases. For this purpose the writer prefers Healey's Artificial Stone (manufactured by Jay E. Healey, New York City) because it withstands the force employed in swedging and is not compressible. The time required for setting is from six to eight times as long as for either of the other two mentioned. It is more expensive than Spence's plaster compound.

**Impression Is Assembled and Particles Sealed with Hot Wax.**—In the event that portions of the plaster impression have been broken away during the removal from the patient's mouth, these should be replaced and sealed in position before the impression is treated. In such instances the impression and the particles should be allowed to dry until all free moisture has evaporated, before assembling. Ten or fifteen minutes is usually sufficient for drying, and this may be reduced by the use of compressed air or by placing before an electric fan. In sealing the particles in place, the pink wax may be used.

It should be very hot for this purpose. If extremely hot, the wax will penetrate and effect a union beneath the surface instead of leaving a superfluous coating upon it.

**Treating the Impression with a Filler and a Varnish.**—The impression should then be treated with some preparation which will fill the interspaces or pores of the plaster. With these filled, the surface of the impression becomes more continuous and the cast made upon it will have a smooth surface. There are a number of proprietary preparations on the market. Of these "Separlac" manufactured and supplied by the Ransom & Randolph Co., Toledo, Ohio, enjoys a wide use, as does also S. S. White's "Parting Fluid."

**Hall Recommends Collodion as Filler and Varnish.**—Rupert E. Hall, of Chicago, recommends very enthusiastically the use of collodion, which serves both as filler and varnisher. The suggested technic for the use of this medium requires that at least a pint of flexible collodion (Squibb) be provided. To this is added shavings of an indelible pencil lead, in order to color as desired. A sufficient amount of this liquid is poured into a plaster bowl or other vessel to permit complete submergence of the impression. The impression when dry, so far as free water is concerned, is dipped, then removed, and, standing on the posterior palatal border, is allowed to drain for two or three minutes in order to permit the excess to escape; it is then dipped again. The first time provides the impression with a filler; the second dipping serves as a varnish. The intaglio of the impression should be held uppermost while dipping, in order to allow the air to escape. The impression should be removed as soon as coated, since ether, the solvent of collodion, may attack the compound of which the tray is made. Immediately after the dipping is completed, the remainder of the solution should be poured back into the bottle and securely corked. When it becomes too thick, it may be thinned with acetone and ether. The plaster bowl should be cleaned at once.

It is impossible successfully to paint collodion on the impression. Prior to pouring the impression with cast material, the impression should be soaked in water and the surface then painted with soapsuds; excess soap is then washed off in running water. The soap serves as a separating medium.

This ether solution of collodion is highly inflammable and should be kept away from the open flame.

**The Author Continues to Use Shellac as a Filler and Sandarac as a Varnish.**—The author, after trying practically all of the various media, still continues to use an alcoholic solution of orange shellac as a filler,

and a similar solution of gum sandarac as a varnish. No further separating medium is required. These are usually applied with a brush, although the impression may be dipped in the shellac if desired; if this is done, the excess may be thrown back into the bowl by a quick motion of the hand which avails itself of the law of inertia. Care in preparing these solutions will be repaid. If large quantities are prepared at one time, the results will be more satisfactory.

**Preparation of Shellac Filler.**—In preparing this shellac filler, four ounces of orange shellac are dissolved in sixteen ounces or a quart of non-beverage grain alcohol; this solution is allowed to stand for a day or two and is shaken occasionally during this time; it is then filtered free from any heavy or partly undissolved particles, using fine filter paper in the process. The filtering process will result in an evaporation of some of the alcohol, which finally leaves approximately a 22 or 23 per cent solution. As more evaporation takes place, alcohol may be added to preserve the desired consistency. Orange shellac in solution may be purchased at any paint store, and the desired solution obtained through the addition of alcohol.

The sandarac varnish is prepared in the same manner.

**Applying the Filler and Varnish.**—After the impression has been painted with shellac and allowed to dry, it should be given another coat if it still appears porous. A third coat may be applied, if it still seems porous, after the encasing plaster has been trimmed. At any stage, whether the impression is ready for another coat may be determined by touching to the face; if the last coat is still sticky, it has not yet dried sufficiently. The trimmed plaster encasement may now be covered with one or more coats of the sandarac varnish, depending upon the thickness of the varnish. The purpose of the varnish is to provide a glossy surface which will result in a smooth cast. Sometimes the varnish is too thin to provide a gloss; in such case a second coat is necessary. The thinner the coating required to give the desired gloss, the more acceptable, since any coating at all reduces the cast infinitesimally; heavier coats might undesirably affect the size of the cast.

The use of the wax wire to protect the border of the impression during the process of encasing it is described in Chapter I. Of course, the expert is able to dispense with this aid.

The strips of rubber used for forming the matrix in which the cast is formed may be made of an old auto tube.

**Cast Should Be Treated with Respect.**—The cast should be treated with the same respect which the careful operator accords a wax pat-

tern for a gold inlay, since any imperfection of the cast tends to imperfection in the finished denture. While some imperfections may be so slight that they may be overlooked without injury to the denture, others are often sufficient to keep the denture from properly seating. Constant and painstaking endeavor will be amply rewarded.

Detailed technic of cast-making is presented in Chapter I.

## CHAPTER IX

## OCCLUSION

**The Term, "Occlusion," May Well Apply to Relationships of the Teeth, Leaving "Articulation" to Refer to Temporomandibular Joint.**—Occlusion is the term employed to designate the contact relationships of the teeth of the maxilla with those of the mandible. The author prefers to use the term "occlusion" together with related forms of the word, to the exclusion of the word "articulation" in treating of these relationships; "articulation" may properly refer to the temporomandibular joint. Some authors and lecturers have employed "articulation" to designate "the various contact relationships of the occlusal surfaces of the teeth while in action, in contradistinction to occlusion, which is properly applied to these surfaces in contact and at rest." The author does not find that any scientific accuracy or understanding is given to full denture prosthesis through such differentiation. Any contact of a maxillary tooth with an opposing mandibular tooth constitutes occlusion; in action there is a series of occlusions; it adds nothing to an understanding of the series to call them by another name—"articulation." If in favor of the term, it is pointed out that "articulation" has come to be the accepted designation of relationships of the occlusal surfaces in moving contact, the objection is equally valid that "articulation" is also employed in referring to an entirely different portion of the masticatory mechanism. Certainly, to reserve the term to apply to the temporomandibular joint will avoid confusion. "Functional occlusion" is sufficiently inclusive of the relationships of the occlusal surfaces to designate these relationships throughout, viz., in contact and at rest, moving and after passing out of contact, moving and about to make contact, at rest and not in contact—actual, theoretical, incipient, completed.

**Definitions.**—*Central occlusion* is a rest contact relation of the mandible and maxilla, from which all movements of the mandible may be conveniently considered as taking their start. This relation is the one in which the condyles are in their habitually most retruded position. By "rest" is meant "not moving"; when the mandible is at rest, meaning that the muscles are relaxed, it is not in an occlusal contact with the maxilla. The occlusion contact is made, of course,

through the wax occlusion models or through the teeth, artificial or natural.

*Lateral occlusion* is a position of the mandible to the right or left of the one designated as that of central occlusion. When in right lateral occlusion, the teeth on the right side of the dentures are in position for masticating on the right side; in left lateral occlusion the teeth of the left side are in position for efficient mastication. When one side is in position for masticating the food, the other was formerly described as in balanced occlusion. With the advent of the Hall method of setting the teeth, the distinction has lost its significance, since the masticating side is also in balancing occlusion through the bolus of food.

*Protrusive* and *retrusive occlusion* respectively designate those relationships in which the mandible is in a position anterior or posterior to the position designated as that of central occluson. Protrusive occlusion is of importance in incising movements of the mandible, and any movement from protrusive occlusion to central occlusion may be properly designated as retrusive.

**Ideal Occlusion in Full Dentures.**—In full denture prosthesis, the *ideal occlusion* is that which provides the most efficient masticatory apparatus to be worn with lasting comfort and at the same time permits the most pleasing esthetic effect. It is safe to say that the most efficient occlusion may be the most comfortable. At least it is usually not necessary to sacrifice comfort in order to secure efficient masticatory substitutes. Often, however, it is impossible to provide the maximum of efficiency in mastication together with the most pleasing esthetic result. For example, sometimes the esthetic requirements make it imperative that the interval between the ridge of the maxilla and that of the mandible be so great (in order to preserve the correct or harmonious relationship between nose and chin), that the tongue is unable to reach the buccal surfaces in order to retrieve food which has been pushed over against the cheeks. When this interval is shortened, the tongue is able to function satisfactorily in this regard, but the facial proportions are not then so harmonious. It is also possible by disregarding this interval to construct artificial dentures which greatly enhance masticatory stress through a change in leverage (Fig. 163).

**Arrangement of Artificial Teeth Follows Plan of Natural Teeth, But Is Modified by Demands of Movable Bases.**—In setting up the artificial teeth, the principle to be followed is that which was followed in the case of the natural teeth—they were set in such manner

as to intercusp with the greatest possible shearing, macerating and expressing action during the masticatory movements. While this principle is followed as closely as possible according to the examples which may be studied in arrangements of natural teeth (see Figs. 66 and 67), it is necessarily modified because artificial teeth are not set in immovable bony structure, but upon bases which are not integral parts of the ridges. Accordingly, the principle followed in Nature, modified by the necessity of balancing artificial dentures under the various stresses exerted, determines the prosthetist in his alignment of artificial teeth.

**Teeth May Be Set Up to the "Occlusal Plane"—If Only Masticatory Efficiency Is Demanded.**—As a specific direction with a view to masticatory efficiency only, the operator may be instructed to set the grinding or incising surfaces of the teeth on a line midway between the maxillary and mandibular ridges. This line is frequently defined as a line lying within an imaginary plane extending from the edge of the upper lip, at rest and relaxed, backward at right angles to the sagittal plane, and parallel with a line drawn from the alae of the nose to the lower border of the external auditory meatus. While such an arrangement of the artificial teeth would provide a satisfactory masticating arrangement, esthetic requirements may lead the operator to set the maxillary centrals slightly below and the laterals slightly above this line; the cuspids may rest upon it or drop slightly below (depending upon the length of the cusp), while the first and second bicuspids and first molar may remain upon it, the second molar slightly above it.

On account of difference in degree of resorption of the two ridges following removal of the teeth, the occlusal plane varies. The operator should let the position of the line be determined by the length of the upper anterior teeth. When these are properly aligned the height of the lower occlusion model will be such as is then necessary to maintain the desired distance between the patient's nose and chin.

**With New Moulds of Posterior Teeth, Compensating Curve May Be Eliminated.** With the new moulds of posterior teeth now manufactured by The Dentists' Supply Co., it is possible by means of a proper depth of overbite in the anteriors to ignore a system of alignment formerly necessitated because the teeth were not supplied with deep bite cusps. See moulds 134 L and 137 L in Fig. 63. While different definitions of the *compensating curve* have been given by different authors, the above fact indicates that there is considerable justification in defining the *compensating curve* as a curve which, in aligning the artificial teeth, the operator should follow in order to compensate for

the failure of the manufacturers to provide posterior teeth of suitable mould or form.

**Overbite Is Arbitrarily Determined.**—In the preceding paragraph, reference was made to "proper depth of overbite." The use of "proper" in this connection merely signifies that such depth of overbite, as would be chosen in order to eliminate the compensating curve, would be correct or proper for such purpose. The fact is that the depth of overbite for the teeth of any case is arbitrarily determined by the operator. However, a deep overbite adds shearing power to the teeth and requires less force to penetrate morsels of food; except in rare instances a deep overbite is always indicated; this does not necessarily mean deep cusps, since this usually varies with the age of the patient and the flattened condition of the ridges. Whatever the overbite, there is a constant relationship between this and the relation of the second molars to the occlusal plane. The more nearly the second molars are inclined to an angle of forty-five degree with the occlusal plane, the deeper will be the overbite; while they are often inclined at this angle, it is never exceeded. This constant relationship enables the artificial dentures to maintain a contact between maxillary and mandibular occlusal surfaces such that they will at all times when stress is exerted against them press more firmly against the ridges upon which their bases rest.

**Balanced Contact, "Three-point Contact," and Hall's Idea of Balanced Contact Through the Bolus of Food.**—Such contact as has just been mentioned is often referred to as balanced contact. In times past, there has been a certain fascination among writers and speakers in referring to "three-point contact." They have had in mind the balancing of the dentures when the mandible is moved laterally, a balancing of the maxillary denture upon the mandibular denture after the fashion of a three-legged milk stool on a barn floor. This kind of contact has seemed to many to be a desirable relationship, despite the fact that the third point of contact between the dentures may disappear as soon as the teeth are engaged in performing their masticatory function. It is only in recent years that emphasis has been given to the fact that not only the third point but all points of direct contact are lost when a morsel of food is engaged, unless the teeth are set up to a deep overbite and provided with two points of direct contact which allow for a third point of indirect contact where the food awaiting comminution keeps the contact from being direct. Rupert E. Hall introduced this innovation and the dental profession is indebted to him for this new idea of balanced contact in artificial dentures.

**Occlusal Surfaces Ground to Assure Unhindered Movement.**—Nature is not interested in this balancing, because there is no danger of unseating the other teeth when proper provision is not made. In artificial dentures, the artificial teeth should be set up with a deep overbite in order to secure the best shearing action with the least force, and then the teeth should be ground automatically so that at every conceivable stage of the shearing and retrusive movements this shearing edge is balanced and free to function unhindered by irregularities of the path along which it must travel. Even in Nature, after the cusp paths and harmonious relationship preserved in the gliding movement have been long established, decay or extraction may permit a misalignment and thus furnish an obstacle in the path of this previously beautifully coordinated mechanism. It is obvious that in the case of a natural tooth improperly aligned, motions of the mandible in masticatory effort will bring the full force of mastication against it. This continued trauma will produce irritation which is one of the most potent factors in producing periodontoclasia.

**Trauma Due to Improper Intercusping of Artificial Teeth.**—If the cusps of the artificial teeth are not synchronously and harmoniously aligned and ground so as to permit unhindered movement in mastication or other mandibular action, the patient will often present himself with the mandibular base irritating some portion of the ridge. In an endeavor to relieve this irritation, the dentist ordinarily cuts away a portion of the base. The patient returns in a day or two to report that the previous point of irritation is relieved, but that another one has developed on the opposite side of the mouth. The cutting away of the base again is resorted to as a means of relief, only to have the patient return with an irritation entirely new and we might say remote from the previous ones. When this occurs five or six times without avail, the dentist may recall his college days and the professor's advice about finishing a "lower plate"—"Trim the lower until you think that you have ruined it, then trim it some more." The real difficulty lies in some plane of a tooth cusp. This plane is malaligned with reference to the harmonious arrangement of the remaining twenty-seven teeth, and under the stress of mastication the force brought to bear upon this inclined plane causes the whole denture to "skid" or move sufficiently to irritate the mucosa. A case of this kind may often be easily remedied by mounting the dentures upon an articulator and automatically grinding to perfect the occlusion.

**Irritation of Mucosa Less Likely with Less Depth of Cusp.**—Such irritation as just mentioned is less likely to arise if no effort has been

made to provide an intimate intercusping relation of the cusps of the two dentures. The less depth to the cusps of the teeth, the less likelihood there will be of such irritation, since the force exerted against the inclined planes of the opposing cusps is not sufficient to move the base upon the tissues. Those who are satisfied to supply dentures with teeth having practically no cusps will avoid almost entirely the trouble to which reference has just been made, but those operators and their patients will never know what is meant by efficiency as applied to artificial dentures.

**Example of Kind of Movement with Improper Intercusping.**—If an example is selected in which the proper relationship has not been established between the occlusal surfaces of the teeth of the opposing ridges—for instance, the central occlusion as registered is incorrect to the extent of one or two millimeters, the following will probably occur: When the patient attempts to close into his habitual central occlusion instead of the occlusion provided for him by the prosthetist (the patient closes the mandible into a position slightly retruded compared with the position intended by the operator), the distal plane of some cusp of a mandibular tooth will occlude with the mesial cusp plane of a maxillary tooth. Then, he will habitually try to move the mandible backward into correct occlusion, but instead, being forced by the muscles of mastication against the inclined planes of the cusps, the base of the denture must yield—this results in irritation of the mucosa.

**Determining the Cause of Irritated Mucosa.**—When the patient reports the dentures as uncomfortable, and investigation discloses points of irritation or sore spots on the mucosa, the prosthetist, suspecting that the cusp relationship may be incorrect, may proceed in the following manner to determine definitely whether this is the cause of the difficulty. The bases should be securely seated by means of powdered gum tragacanth or some other adhesive, and the patient requested to open and close very slightly but in rapid succession and to vary the opening and closing by retruding and protruding the mandible during the process. The operator may be able by observing this opening and closing to note whether the cusp relationship is perfect or faulty. No attempt should be made to correct imperfect occlusion of this kind by means of carbon paper and mounted stone, but the dentures should be remounted upon the articulator, and the cusps ground to a new relationship. Before remounting, the new and correct relationship between the cusps should be secured by covering the mandibular teeth with warm carding wax over the occlusal and incisal surfaces, and then having the patient to close against this into correct

central occlusion. If it is evident that the central occlusion lacks more than two millimeters of being correctly established, no attempt should be made to correct by grinding; one of the dentures should be entirely reconstructed, usually the mandibular.

**When Necessary to Change a Peculiar But Habitual Masticatory Movement.**—A patient, who has developed an unusual masticatory movement in an endeavor to secure the greatest efficiency with his few remaining natural teeth, may tend, after all of his teeth are removed and artificial dentures are provided, to repeat this peculiar and abnormal but habitual movement. This abnormality may be corrected by finishing the final masticatory stroke of the new dentures at a point at which the abnormal movement of the mandible with natural teeth began. This correction, of course, may easily be made by lengthening the interval between the two ridges.

**Extramasticatory Movements Disclose High Points of Cusps.**—Occasionally, a patient engages in mandibular excursions which extend beyond the ordinary or habitual range of movements customary in the course of mastication. These excursions are indulged in when there is no food in the mouth, but in such movements the patient strikes the high point of a cusp and—just as in the case of natural teeth—trauma results. Investigation shows that the relationship between the maxillary and mandibular denture in masticatory movements is satisfactory; in such instances, the use of carbon paper and small carborundum stone will quickly reduce the point of offense and thus remove the cause of the irritation which appears upon the mucosa.

**Slight Roughness of Base Easily Removed.** Of course, irregularities of the base which rests upon the tissues may need to be removed to prevent irritation, but many dentures have been ruined by operators who failed to recognize that incorrect intercusping was responsible for the discomfort which they thought due to some roughness in contact with the mucosa.

**Precaution in Preserving Intercusping Relationship Which Has Once Been Approved.**—When the teeth have been set up in the wax in such intercusping relationship as an individual case requires, the operator should place them in the patient's mouth for a final test of this relationship before flasking and vulcanizing. The black carding wax employed upon the mandibular teeth will enable the operator after removing the occlusion models to judge of the desired intercusping relationship. If too much rubber is used on one side in packing the case, or if too much pressure is exerted upon one side through screwing down the bolts of a flask, the relationship after vulcanizing may

differ with that originally approved. If the trial method is employed in packing, and if a spring is used instead of bolts in flasking, the relationship will not be unduly distorted.

**Providing a Check to Judge Treatment of Occlusion When Case Is Sent to Laboratory.**—The dentist who finds it necessary to send his denture cases to the laboratory should, before sending, provide himself with a check upon the intercusping relationship as he has established it. Then he may determine whether this has been altered in some of the processes through which it passes after leaving his hands. Such a check may be provided while the teeth are still in the wax. The operator may pour a plaster matrix sufficient to include the occlusal surfaces and the incisal edges of the teeth; when the case is returned from the laboratory, the teeth should fit into this matrix.

**If the Dentures Out of the Mouth Are Not Balanced, Results in the Mouth Will Not Be Different.**—After the teeth are finished and polished, the intercusping relationship may be tried by placing the dentures together. If the dentures rock when thus placed together, the operator may be sure that the relationship in the mouth will be no more acceptable.

The occlusion is perfected as nearly as possible, through automatically grinding as described in Chapter I.

## CHAPTER X

## SECURING CENTRAL OCCLUSION

"Securing Central Occlusion" is a more acceptable designation of the operation which formerly was characterized as "Taking the Bite." The problem involved in the procedure of securing central occlusion is that of securing a desirable relation of the maxilla and mandible in such a way that this relation may be maintained between the casts when they are mounted upon an articulator.

**Definition.**—Central occlusion has been defined as a rest contact relation of the mandible and the maxilla when the condyles are in their habitually most retruded position. (Rarely this retrusion is too pronounced—so rarely that such retrusion will not be considered in this connection.)

This definition, as previously given, included also the idea that the relation is one from which all movements of the mandible may be conveniently considered as taking their start. This relationship is a normal, natural or habitual relationship. This habitual occlusion relationship is easiest to obtain, when, at the time of obtaining it, the other actions of the patient are habitual, normal or natural. These actions are normal, or natural, or habitual when the patient's processes of thought are following accustomed or habitual channels.

**The Problem Is Largely Psychological.**—The problem, therefore, of securing central occlusion is in large measure the psychological problem of encouraging in the patient, at the time of closing to central occlusion, processes of mind which habitually or ordinarily accompany this closing movement. The psychological factor involved is, accordingly, so important that the author is prompted to assert that this factor outweighs the physical or mechanical provisions together with the physiological considerations of the case. In support of this assertion, readers can summon instances in which the psychological factor has been strong enough to defeat every effort of the operator. Negatively, it has operated so effectively that the most exact workmanship, as well as the most favorable conditions of mouth tissue will not assure successful dentures. In the case of the patient whose attitude remains at cross purposes with that of the prosthetist, the most perfectly constructed dentures will not give satisfaction. On the

other hand, considering this factor in its positive aspect, with the patient striving earnestly to cooperate with the prosthetist, some very imperfect workmanship may be rendered genuinely serviceable. These two phases—the negative and the affirmative attitudes with reference to the prosthetist's efforts—are mentioned, preparatory to the statement, that, in securing central occlusion, the prosthetist desires to have neither of these attitudes assumed by the patient. That is to say, he certainly does not want the patient to oppose his efforts; on the other hand, he does not desire the patient to render any consciously directed specific cooperation. If it were possible, the operator would like to have the patient register a closing movement of the kind desired while the patient is not thinking about closing movements at all—a closing movement of the mandible such as he registers hundreds of times daily, when his mind is occupied with other matters.

**Closing into Central Occlusion Is a Habit.**—In making preparations to secure the central occlusion relationship, the operator should remember that the desired closing movement—that movement which closes into central occlusion—is in many respects similar to other movements which, taken in series, form habits, and which, as habits, are usually performed most easily when the mind of the performer is not concentrated upon any particular movement of the series. The effort to separate an act from the series in the midst of which it usually occurs is often not only confusing but utterly unavailing, because the act has not thus been considered. Not many can say just how they start or finish simple habits, such as putting on a coat —is the left or right arm the first? A question regarding the *how* of a specific act is not readily answered and a direction of this kind is usually very confusing to a patient who realizes that his response to "Close naturally!" may determine the success or failure of the prosthetist's efforts in denture construction.

**The Prosthetist Should Be an "Observer" of a Habit.**—If an observer is able to witness the putting on of a coat, or the broad-jumping contest, or the alighting from a train, or the closing natural to the patient, he should easily be able to state authoritatively the method usually followed. As nearly as possible in similar manner the prosthetist as an observer should secure his record of the usual relationship of the maxilla and mandible when they are in contact (extended contact through artificial teeth or wax occlusion rims) and with the condyles in the most retruded position.

**Conscious Attention Often Confusing and Inhibiting.**—As a rule, the more completely a person's attention is diverted from his method

of executing a movement, the more nearly will a normal or habitual movement result. When a person, especially a child, "tries" to swallow a pill or a capsule, the act of swallowing often becomes an impossibility; a musician endeavors to follow each movement of his fingers as he plays a familiar selection and he finds himself floundering through an easy passage; perfectly mastered series of coordinated reflexes, as simple in their execution as walking, talking, or writing are often the source of much confusion and embarrassment when the performer turns his attention to a particular phase of the series.

**"Bite" May Also Suggest a Movement Not at All in Accord with the Prosthetist's Desired Central Occlusion.**—Accordingly, during the process of securing central occlusion no mention of "bite" should be made, because this word may suggest to the patient a peculiar movement which is not at all in accord with the movement desired.

**Summary of Prosthetist's Attitude in Securing Central Occlusion.**—The psychological aspect is discussed more at length in the chapter, "Some Psychological Phases of Full Denture Prosthesis." Here it may be sufficient to summarize the prosthetist's attitude: All suggestions to the patients that may tend to direct them to the specific movements desired in closing into central occlusion should be omitted; exhibition on the prosthetist's part of impatience, disappointment, or disapproval because of patient's failure to close as desired should be avoided; and all movements of the mandible encouraged and observed in order that the desired one may be secured and recorded. Nothing should be said or done which tends to keep the patient's closing movements from being habitual, but everything which may induce habitual movements of the mandible should be considered important.

**Control of Psychological Factor Through Preparation of Occlusion Models.**—While the mental factor has been stressed as the most important in the process of securing central occlusion, it is influenced very largely by material factors which are almost wholly within the prosthetist's control. Consequently, the psychological problem is in large measure solved when the prosthetist has made careful preparations in anticipation of the final movement in the procedure.

Quite obviously, the material factors which will be most vital in securing central occlusion are the occlusion rims. These should be constructed with much care, and the finish and polish should be comparable, so far as the material permits, to the finished dentures. In constructing these, the depth of wax is always left greater than the operator believes the case will require, since at the chair wax is more easily removed than added.

**Selection of Teeth and Arrangement of Six Maxillary Anteriors Before Securing Central Occlusion.**– The author's method of securing central occlusion includes as part of the preparatory work the selection of the teeth and arrangement of the six maxillary anteriors. Selection of teeth is discussed in the chapter on "Esthetics," and the method of arranging them on the bases is treated in Chapter I.

**Friend or Relative "Assists" in Selection and Arrangement of Teeth.**—In arranging as well as in selecting the teeth it cannot be stressed too strongly that some one or more members of the patient's family should be present. The one who will be most interested in mother's or father's, wife's or husband's appearance, will be the most helpful. The real helpfulness will be manifest when the patient returns home wearing the dentures. While the teeth are being selected, the skillful prosthetist will lead the member or members of the family to approve of his selection of teeth suitable for the patient. If these approve of the selection, they will champion the appearance of the patient whenever others comment adversely. Sunken cheeks will have been more nearly rounded, lips will be full; it will be unusual indeed if the change is not as noticeable as a different hat or cravat—not all will agree as to the appropriateness of all phases of the esthetic result.

Neither the patient nor the friends or relatives who have come to "assist," know as well as the prosthetist what is needed to restore or enhance the esthetic effect; particularly is this true with reference to sizes and shades or hues. "Mother used to have pretty white teeth," remarks the daughter, and the prosthetist will wisely accept this bit of personal history without any discrediting remark and choose from the hue guide the whitest tooth (No. 1) to hold in position in mother's mouth. He may observe, and patient and "assistants" will usually be quick to concur, "This is much too light." Similarly, the darkest one of the hue ring is seen to be too dark. Then the prosthetist may select the tooth which he has already decided is most suitable, and, pronouncing it harmonious not only in shade but also in size, expectantly look for patient and "assistants" to agree. Selection is more easily made if it is possible to keep the rest of the hue guide from being brought into view. The dentist contributes largely to a successful case when he secures the cooperation and approval of patient and other persons interested and at the same time enables them to make his selections fully theirs.

**Occlusion Model Should Not Be Displaced.**—Before the maxillary occlusion model is inserted preparatory to selecting and arranging the

six anteriors upon it, the operator should sprinkle the base of it with powdered gum tragacanth or some one of the similar preparations. The base of the occlusion model, which has been adapted to the surface of the cast with the fingers, cannot possibly be as well adapted to the tissues of the mouth as one moulded during the process of vulcanization or during a process of constructing a cast-swedged base, and psychologically it is not wise to permit the trial base to become dislodged during the trying-in processes. While unjustifiable expectations should never be encouraged, neither should the prosthetist have any part in arousing unwarranted fears. Accordingly, the author always sprinkles some of the sticky preparation in the base; then the patient will not look forward with doubts about the finished denture, or with fears that it may be too easily displaced. This is the practice, whether the bases are made of Graft's, vulcanite, or metal. Such a time is ill-chosen for testing the adaptation. The dentist in his anxiety to have the base well adapted may at such a time give some facial expression indicative of his disappointment or misapprehension, in case the base does not meet his expectations. This, of course, should be avoided, since a failure at this time of the base to "stick" is by no means an indication that the finished denture will not be a genuine success. Neither is one that sticks a guarantee that the finished denture will not be a miserable failure. Especially during the process of securing central occlusion the patient's mind should be as undisturbed as possible in order that movements of the mandible may be natural.

**Three Teeth Are Arranged.** With the maxillary occlusion model securely seated, the lip line and the median line are marked; the model is then removed and a portion of wax large enough to admit a central, a lateral, and a cuspid, is cut away. Fig. 167 shows the occlusion model with these three teeth in position. Fig. 168 shows the three teeth in the patient's mouth.

**Six Maxillary Anteriors Arranged.** Since the lip line is now maintained by these three teeth, the adjoining sections of wax may be removed and three teeth put in position on the other side. Figs. 169 and 170 show the six anterior teeth in position.

**Occlusion Models Are Prepared so as to Avoid Interference in Closing to Central Occlusion.** When the six anterior teeth have been arranged to the satisfaction of all concerned who are present, the maxillary occlusion model is removed and the wax in the space to be occupied by the bicuspids and molars is sloped to a narrower width at the

occlusal surface. The wax in these regions is formed to that of an inverted "V" or wedge so that, when the jaws are being closed the resistance will be minimized. A notch is cut in the wax on each side in the region of the first molar; this serves to prevent improper

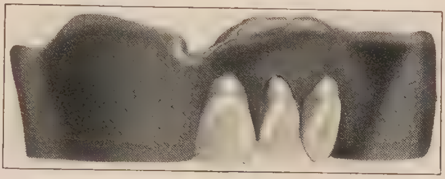


Fig. 167.—Maxillary occlusion model with first three teeth in position.

Fig. 168.—Maintaining the median line and lip line with teeth as they are to be incorporated in the finished denture.

Fig. 169.—The six anterior teeth aligned preliminary to securing central occlusion, and for the patient's approval.

placing of the rims when they are separated and then placed together again. The notches prevent any shifting of anteroposterior relationship. The posterior border of each ridge is sloped off near the tuberosities as shown in Fig. 70. This is an additional precaution to avoid interference with the mandibular base.

**A Tooth Is Placed on the Mandibular Base as a "Stop."**—The mandibular occlusion model is now placed in position and the lip line is indicated. After removing it from the mouth, the wax is removed down to the base plate a distance on each side of the median line equal to the width of the incisors and cuspids. If any single phase

Fig. 170.—Final arrangement of the six anterior teeth embodying median line, lip line and contour before securing central occlusion.

Fig. 171.—A mandibular central incisor is placed on the base to serve as a stop when the patient closes into central occlusion. This figure shows the pools after the wedge-shape maxillary rim has closed into them.

of this method of securing central occlusion may be said to be the most important, then *the absence in the anterior portion of the mandible of anything upon which to bite* constitutes this factor. A mandibular central incisor is now waxed firmly in position, properly observing the lower lip line (Fig. 171). This mandibular central is placed in the median line, or to either side—it will be moved to its

correct mesial or distal relation when later the teeth are all set up. Its sole function now is to act as a guide so that the prosthetist may stop the patient's movement when the jaws close sufficiently at the moment of securing central occlusion. The cutting edge of this mandibular central incisor often follows the lingual plane of the maxillary central incisor and thus serves also as the guide in bringing the mandible into the desired retrusive position.

**The Wax of the Maxillary Occlusion Rim Is Chilled, That of the Mandibular Is "Pooled."**—The maxillary occlusion rim should be thoroughly chilled before being inserted, so that the wedge-shaped wax will easily be pushed into the mandibular rim when the jaws are

Fig. 172.—The mandibular occlusion rim in position, with wax pooled ready for the patient to close.

closed. It is then placed in position in the mouth. The mandibular occlusion rim is further prepared by running a hissing hot spatula into the wax along the bicuspid and molar regions on both sides; the spatula is pushed to place on one side and the first bit of melted wax is thrown out. The other side is treated in like manner. Again the spatula is heated hot, and moved along as closely to the border as is possible without breaking the outer edge which serves to retain the melted wax. The wax is melted through to the base and the operation continued alternately upon each side until two veritable pools of wax have been formed. When the wax of these pools has congealed sufficiently to keep them from overflowing, the mandibular model is inserted and held in position on the ridge (Fig. 172), using

the index finger of each hand for this purpose, while the patient closes. *This is the first time that the two occlusion models have been in the mouth at the same time.*

**Prosthetist Suggests Desired Closing Movement for Imitation by Patient.**—Instead of *requesting* the patient to close, the operator, as he approaches with the mandibular model ready to insert, may open his own mouth rather wide and the patient will respond to the *suggestion* by opening his mouth in like fashion to receive the model. When it is in position and held as indicated, the operator may close his own mouth with a click or snap to central occlusion, and the patient will respond with a similar movement.

Fig. 173.—The operator employs the index finger of each hand to press the mandibular occlusion rim into position upon the mucosa, while the patient closes into central occlusion.

**Final Closing Movement Is in Habitual Response to Stimulus.**—The physical behavior following the first sense of touch, which comes at the moment of practically nonresisting contact of the mandibular with the maxillary wax occlusion rim, is similar to any other habitual response to a stimulus. In reacting to this stimulus of contact, response is made to the only guide that has been provided, and the mandible closes in correct relationship with the maxilla (Fig. 173). The soft wax, of course, is not a true guide, such as the planes of the cusps of the teeth provide. Fig. 174 shows the occlusion rims in correct relationship.

**Tooth Serves as Guide to Prosthetist in Preventing Undue Closing.**—Since the wax is soft enough to permit it, the tooth which serves

as a stop may be pressed up into the wax of the maxillary rim, unless the operator stops the closing movement at the moment when this central incisor touches the maxillary occlusion rim at a point near the pin guards of the central incisors. At this point, the interval between maxilla and mandible will be correct; this is correct when the

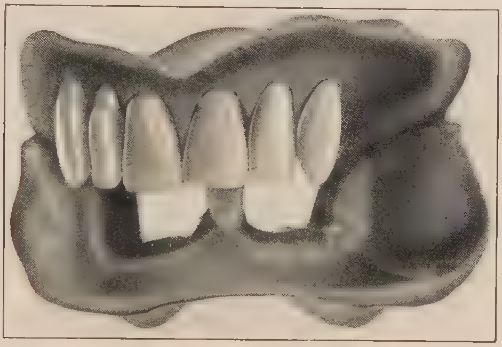


Fig. 174.—A case showing occlusion rims in correct relationship.

Fig. 175.—This figure shows lips slightly protruding which is the normal position when the jaws are closed.

lips come together in normal fashion. When they come together, they will appear full and slightly protruded. The profile view in Fig. 175 shows the lips when the jaws are closed as desired. After the wax has been allowed to cool for a minute or two, both maxillary and mandibular models may be removed together or separately and then im-

mediately chilled. Note the impression which the maxillary occlusion rim has made in the mandibular rim (Fig. 171). No marks or staples are necessary since with this method the operator has the assurance that the two rims will fit together again as accurately as if they were respectively die and counterdie.

**The Gysi Method of Securing Central Occlusion Requires Less Tact But More Labor.**—The method of securing central occlusion employed by the author is the one just presented. For the benefit of those who have had little experience in denture prosthesis, and who may find that some phases of this method require the exercise of more experienced judgment in execution another method is given. While it probably entails additional time and effort, the certainty and regularity of results secured will undoubtedly recommend its use to a great number of practitioners. It is given by Dr. Gysi, and the instruments used were also designed by him. The author employs The Horseshoe Plate and Incisal Path Marker of the Gysi Adaptable Articulator Outfit. Following this method, the mandibular occlusion model is provided with the horseshce plate and the anterior portion of this plate is blackened by burning beneath it a pledget of cotton saturated with oil of cloves or some other of the essential oils. The maxillary occlusion model is provided with an incisal path marker which is placed in the median line (Fig. 176). When the models are in position in the patient's mouth, being placed so that they are in contact along their entire occlusal surface and glide freely upon each other, the catch which holds the marker is released, allowing it to touch the blackened surface of the horseshoe plate. The patient is encouraged to move his mandible in every direction possible—anteriorly, posteriorly, and laterally—while contact between the two rims is maintained. Among various other lines, the marker will describe arcs of two circles which will meet in the form of a Gothic arch (Fig. 177). The point of intersection, or the zenith of the arch will find the mandible in its most retruded position, which is the position of central occlusion.

**Value of Mechanical Aids.**—While it will always be true that there is too much of the artistic and esthetic involved in prosthetic dentistry, as well as individuality in each case confronting the operator, to permit of the standardization of results or procedure in any real sense, the author desires to emphasize the value of this mechanical aid to certainty in registering central occlusion. On account of the fundamental character of the object to be attained, this mechanical aid to securing it may well prove to be of greater benefit to the gen-

eral practitioner than will any other mechanical aid, which is at present offered to those interested in full denture prosthesis. It scarcely need be observed that no prosthetist, sure of his method of securing central occlusion, will avail himself of such a mechanical aid. Such skilled operators—the ones who are most likely to make

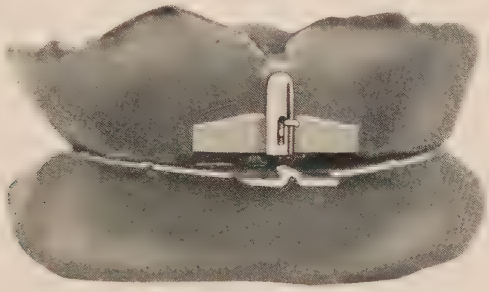


Fig. 176.—The Gysi horseshoe plate and incisal path marker in position on the wax occlusion rims.

Fig. 177.—The central occlusion relationship is recorded when the marker rests upon the zenith of the Gothic arch (or as it appears here, upon the apex of the triangle which has been described).

effective use of such mechanical aids as tooth form finders, motor-driven automatic grinders and similar ingenious devices—are the operators sufficiently skilled to dispense with them. However, this mechanical aid to securing central occlusion is an exception to the rule. The general practitioner as well as the novice will find its use very helpful.

In summarizing the contents of this chapter, the following presentations are important:

1. The securing of central occlusion is easy when adequate preparations have been made for securing it.

2. The problem of securing central occlusion is largely psychological.

3. Occlusion models should be finished as smoothly as possible and care taken that no part of them shall interfere with the closing movement.

4. No mention should be made to the patient of any specific movement desired, such as *correct bite;* and no suggestion should be given that the operator wants to get the *natural or normal* relationship of the jaws.

5. The operator should avoid facial or other expression of disapproval or disappointment when movements of the patient do not contribute to success.

6. Central occlusion is a habitual relationship of maxilla and mandible most easily secured when the habitual movements of the mandible are encouraged through encouraging habitual attitudes or processes of the patient's mind.

7. The Gysi mechanical aid and method for securing central occlusion may be depended upon as certain and regular in results.

## CHAPTER XI

## ESTHETICS

**Esthetics as a Hall-mark of Art.** Esthetics in full denture prosthesis is that which stamps the product of the prosthetist with the mark of the artist. Possessing esthetic appreciation, the prosthetist takes his place with the painter of portraits, the poet, the sculptor, and the composer of symphonies; without this sense of the beautiful, the painter is only a mixer and dauber of colors, the poet a rhymester, the sculptor a stoneworker, and the prosthetist a mechanic.

**An Appreciation of the Beautiful May Be Cultivated.**—While it is true that, just as in the case of other faculties of genius, an appreciation of the beautiful is possessed by some individuals in such degree as to separate them for outstanding achievement in their chosen fields of labor, it is equally true that a gift of special talent may be developed. Whatever significance may attach to the saying "poets are born not made," the lives of the great have invariably borne witness to the fact that genius is almost synonymous with capacity for study and work. Ruskin says of Leonardo da Vinci: "We have in this great master a proof of the manner in which genius submits to labour in order to attain perfection." The author of this textbook agrees with the educators who insist that taste may be cultivated and that talent properly aided and encouraged will bud and bloom, which otherwise may never grow to fruitage.

**Teachers in Elementary Schools Give Specific Instruction in Appreciation of the Beautiful.**—Accordingly, this chapter seeks to present the subject of esthetics in its relation to denture prosthesis in a way which, in principle, is similar to the method of approach usually employed in schools of art. In recent years, teachers in elementary grades and secondary schools have modified their programs to include specific instruction in both passive and creative appreciation of the beautiful in everyday life, as well as in the accepted masterpieces of the world's galleries and chambers of art.

**An Analysis of the Beautiful Will Aid in Its Creation.**—Esthetic appreciation is found in some degree in every individual, and every dentist has some sense of the harmony that may be found in teeth and complexion and facial form of acquaintances or others whom it is pleasant to see. With this capacity for recognizing the beautiful

in certain of its presentations, the prosthetist may learn the value of contour and color and proportion in such manner as will enable him to incorporate these in his finished dentures to restore or enhance the beauty of his patient.

**Sense in Which a Standard of Beauty Is Impossible.**—"De gustibus non est disputandum" has often been quoted by those who regard a sense of beauty as something so subjective and peculiar to each individual that a standard or ideal cannot be found. While in a measure this is true—prosthetists may differ in a given case as to which selection and arrangement of teeth is *most* pleasing—there is little disagreement among those of several years of experience as to whether a case is pleasing or not.

**The Prosthetist Cannot Become a Faddist.**—The prosthetist differs from some other artists in that his sense of the beautiful and its incorporation in a product of art must be restricted to conform to his patrons' sense of beauty. An artist's canvas may not be recognized as a work of art until long after the artist is dead; Gothic architecture may seem barbarous, Walt Whitman's verse lack enthusiasts and Wagner be regarded a savage, but all of these can wait for the approval of future generations. The prosthetist must find his tastes and selections and combinations agreeable to the people whom he serves. Not only is this necessary, but his artistic creation must harmonize with a present environment and a new product of his skill will probably be required for his patient after a period of years. To think of doing more than to harmonize dentures with facial form and complexion and age of the patient as he now appears, would be comparable to an artist's effort if he were to paint a picture of a landscape in spring that should just as truly portray a landscape in autumn.

**The Prosthetist May Modify His Patient's Sense of Beauty.**—However, the prosthetist may within narrow limits modify the patient's idea of what constitutes the beautiful—the patient may at least come to approve of large central incisors instead of "small white ones." He may help his patients to recognize as esthetic, dentures which approximate the natural dentures of men and women who universally are acknowledged as pleasing to behold.

## I. A METHOD OF DEVELOPING ESTHETIC APPRECIATION

**Erroneous to Regard Esthetic Appreciation as Unconditioned.**—One of the fallacies associated with a consideration of esthetic appreciation is that the beautiful makes its appeal instantaneously and instinctively, unconditioned by intellect, emotion, or will. Another is,

that in the creation of the beautiful, intuition and instinct determine the result. Regarding the first, it is probably sufficient to recall how quickly an adolescent boy or girl has changed his or her idea as to what or who may be regarded as attractive—compared with the idea of attractiveness which governed only a year or two ago. While the reaction is in a given instance not studied or reasoned, appreciation of the beautiful is a matter of emotion, intellect and will which have been exercised perhaps a thousand times in the course of previous experiences.

**Intuition Results from Innumerable Experiences.**—The second fallacy results from a misconception regarding intuition; this misconception lies in holding the exercise of intuition to be some mysterious, uncanny, kind of unerring guidance in achieving desirable results. The author believes a more correct understanding of the operation of intuition is given in an instance cited by Mill. "A Scotch manufacturer procured from England, at a very high rate of wages, a working dyer, famous for producing very fine colors, with the view of teaching to his other workmen the same skill. The workman came; but his method of proportioning the ingredients, in which lay the secret of the effects he produced, was by taking them up in handfuls, while the common method was to weigh them. The manufacturer sought to make him turn his handling system into an equivalent weighing system, that the general principles of his peculiar mode of proceeding might be ascertained. This, however, the man found himself quite unable to do, and could therefore impart his own skill to nobody. He had, *from individual cases of his own experience,* established a connection in his mind between fine effects of color and tactual perceptions in handling his dyeing materials; and from these perceptions he could in any particular case, infer the means to be employed and the effects which would be produced." Professor John Dewey after quoting this incident, says:

"Long brooding over conditions, intimate contact associated with keen interest, thorough absorption in a multiplicity of allied experiences, tend to bring about those judgments which we then call intuitive; but they are true judgments because they are based on intelligent selection and estimation, with the solution of a problem as the controlling standard. Possession of this capacity makes the difference between the artist and the intellectual bungler." ("How We Think," pages 104-105.) This chapter on esthetics is an effort to analyze the elements of prosthetic experience which consciously or unconsciously—usually the latter, or "subconsciously"—have contributed to desirable esthetic results.

**Pupils of Great Painters Learned to Paint by Painting.**—Pupils of great masters learned to paint by assisting in the preparation of canvases, in the mixing of colors, and by painting with the masters. Practical application under the guidance of an artist in an atmosphere of art made the learning an almost unconscious absorption of the technic of creative art.

*First.*—Let the prosthetic student observe the harmony of natural dentures with face-form and with the complexion of friends and acquaintances, noting particularly the most pleasing features. Let him attempt to determine whether cuspid eminence, or the size or form or color or markings or arrangement of the teeth contribute most to the pleasing effect. Beauty contests conducted by newspapers or magazines will afford opportunity also for the student to measure his concept of beauty with that of the judges and to study the faces with a view to determining the effect which the teeth must produce.

*Second.*—The student of prosthesis will profit greatly by attending clinics and conventions to note and discuss the ideas of esthetics which are embodied in artificial dentures constructed by men who regard their products as worthy of display before other members of the profession.

*Third.*—A skull with its full quota of natural teeth should be part of the prosthetist's equipment in order that questions of leverage and arch relationship affecting alignment of the teeth, as well as other problems, may have a definite and actual basis of solution.

*Fourth.*—Charity patients may be employed for purposes of trial and experiment with different suggestions as to the creation of the most harmonious result.

*Fifth.*—Just as a daily study of harmony of face-form and tooth-form as seen in the routine of business duties or in social intercourse will familiarize the dentist with pleasing esthetic effects, in like manner an album of selected photos may be very helpful. A collection of photos of noted moving picture stars may be obtained from the various moving picture companies and may be used for similar purposes of study. Not only will a collection of this kind serve to familiarize the prosthetist with illustrations of pleasing harmony between teeth and face, but as an aid in enabling a patient to see that large central incisors may be a part of Nature's idea of beauty, such collections have no equal.

*Sixth.*—An introductory course in art anatomy, with special emphasis upon face anatomy from the artist's viewpoint, together with a course in harmony and color values, will equip the prosthetist along

lines of the basic elements in his creative art. Such studies will serve to emphasize such observations as the following: "Rules have been laid down by which an ideal standard has been sought to be fixed, the deviations produced by age and sex being taken into account; while such standards are more or less artificial, and not to be too slavishly followed to the extent of an unnatural uniformity, they certainly are invaluable as expressing a mean which cannot be deviated from to more than a limited extent without transgressing the laws of Nature and producing deformity." (Vanderpoel.)

## 2. RELATIONSHIP OF PERIPHERAL CONTOUR OF ARTIFICIAL DENTURE TO THE ESTHETIC EFFECT

**Fullness of Cheeks and Lips Should Suit Patient's Age.**—When the lips are closed the peripheral border of the artificial denture should be thick enough along the buccal and labial aspects to restore or maintain the lineaments of the patient's face in normal healthfulness of expression. Of course, an elderly patient properly advised will not expect to have all the lines of age removed from his face. But the patient is justified in expecting that artificial dentures will maintain the cheeks and lips in approximately such fullness as befits a face of similar age in which the natural teeth remain.

**Dentures Not Intended to Displace the Beauty Specialist.**—If the patient expects the dentures to correct wrinkles and restore beauty which is not related to, or modified by artificial dentures and which would not be provided even if he still retained his own natural dentures, then these expectations should be discouraged and the patient's expectations in this regard be referred to the surgeon who may be able to raise the tissues of the face and remove crow's feet and wrinkles.

**A Method Employed in Suggesting That Corrections in Facial Form May Be Secured Apart from Artificial Dentures.**—Some prosthetists lengthen the distance between the ridges, which was established when central occlusion was obtained; this is done to a degree of discomfort in an effort to get a more acceptable facial appearance through rounding the features under the chin and lifting the corners of the mouth. The author suggests the employment of the following method to show the patient that the desired corrections are not always properly related to the construction of artificial dentures. The patient should be requested to step from the chair and to stand before a

mirror large enough to show head and neck and shoulders, at least. Then, if the operator will grasp the tissue in the temporal region with the palms of the hands and will raise the tissue of the cheek and neck with the result as indicated in Figs. 178 and 179, the patient will easily see that the desired construction of features is to be obtained in large degree apart from artificial dentures. The result may be made permanent through a minor surgical operation which consists in the excision of a sufficient portion of tissue to relieve the patient of superfluous wrinkles or furrows. Figs. 180 to 182 are drawings intended to show stages of this operation. The author advises this operation wherever it is indicated.

Figs. 178 and 179.—Method of disabusing patient's mind of the idea that artificial dentures will completely restore youthful features. Note condition under the chin, about the corners of the mouth and also of the nose.

**Operation for Removing Excess "Wrinkle" or "Furrow" Tissue.**—Dr. Paul Lux, of Kansas City, performs this operation in the following manner: On each side of the face an area in the temporal region and extending down in front of the ear and around the lobe of the region of the mastoid process, is anesthetized and an incision made. The incision is in the form of a "V," with the lobe of the ear resting over the point of the "V." Another incision is made paralleling the first "V"; the distance between the incisions will be determined by the amount of superfluous tissue, which in the judgment of the surgeon, it is necessary to remove (Fig. 180). The skin is then lifted slightly

and held with the forceps while a scalpel is employed to loosen it from the tissue beneath, sometimes for several inches on cheek and neck (Fig. 181). The two edges are now brought together and sutured with fine silk interrupted sutures (Fig. 182). Provision is made to support

Fig. 180.—An incision in the shape of a "V" is paralleled by another at such distance as is necessary on account of the superfluous tissue to be removed.

Fig. 181.—While the forceps lift and hold the skin, a scalpel is used to loosen it from the tissue beneath.

the tissue of the neck and chin during the period of healing so that its weight will not rest upon the stitches.

The scar of this operation is usually very slight, and since even this may be almost, if not entirely, concealed by the hair, it is to be expected that the results are very gratifying to those who have found that artificial dentures will not always enhance their appearance as much as desired.

**Sometimes a Choice Must Be Made Between Esthetics and Retention.**—The operator should call the attention of the patient to the fact that it sometimes happens that a case requires a decision in which

Fig. 182.—The two edges are brought together and sutured.

either esthetics or retention of the denture must suffer. If the peripheral border is extended sufficiently to hold the lips and cheeks out as desired, their weight and pressure will tend to displace the denture. In many instances the operator will find it wise to supply at long intervals the esthetic aid in this respect by successive additions of compound; this should be penciled on as required, and when finally satisfactory, may be reproduced in vulcanite or porcelain. In cases in which the patient has never worn dentures, it will be especially wise to wait until the patient is wearing them with comfort and a fair degree of efficiency, before the improvement in esthetics is finally completed. See also Figs. 161 and 162 in Chapter VI, showing dentures in which esthetics is subordinated to masticatory efficiency.

## 3. RELATIONSHIP OF TOOTH-FORM AND SIZE OF TEETH TO THE ESTHETIC EFFECT

**Familiarity with Harmony between Faces and Teeth Will Simplify Selection.**—If the suggestions offered in the opening portion of this chapter with a view to developing a sense of correctness in the relationship of the teeth and contour of gum tissue to the rest of the face, have been utilized, it will be practically impossible to select teeth that are not harmonious. It is scarcely to be expected that a freshman student will be able regularly to make selections of teeth which

Fig. 183.—A typical tapering face.

will produce such pleasing esthetic results as those which might be selected by J. Leon Williams, who carved the original Trubyte teeth.

**Training Through Familiarizing Oneself with Trubyte Three Basal Types.**—As an aid similar to the ones offered above with a view to developing esthetic appreciation in the selection and arrangement of artificial teeth, the manufacturers of Trubyte teeth have provided a method which depends upon acquaintance with three ideal types of face-form. Dr. Williams has chosen the "tapering," the "square," and the "ovoid" face-forms as basal types (Figs. 183, 184, 185); several modifications of each of these have been noted and a tooth-

form suited to each has been placed upon the market by the Dentists' Supply Company, of New York. If the beginner will thoroughly acquaint himself with the three *ideal* types and will perfect himself in the selection of the *ideal* form of tooth for each of these, he will be training himself according to thoroughly acceptable principles of development. Artists begin by sketching objects and figures in which the requirements of harmony and proportion are so evident that slight deviations may yield very grotesque results; they paint figures and copy masterpieces until they "feel" the true proportions and cor-

Fig. 184.—A typical square face.

rect relationships. When their skill has thus developed, they are given more freedom to exercise their individualities in giving expression to departures from accepted ideals and to originalities in effects—which are evidences of genuine creative skill.

**Thorough Acquaintance with Basal Types Simplifies Selection of Modified Forms.** If the dentist is thoroughly skilled to select the square tooth for the square face, the tapering tooth for the tapering face and the ovoid tooth for the ovoid face in the case of patients in whom there can be no question as to which type of face the patient possesses (Figs. 186, 187, 188), the selection of a modified square or

Fig. 185.—A typical ovoid face.

Fig. 186.—For a tapering face a tapering form of tooth will be more harmonious. The outline of a tapering maxillary central tooth is here superimposed upon a tapering face. The photo of the tooth is enlarged to the width of the photograph of the face at the condyles; it is then inverted and the outline superimposed upon the face.

modified tapering or modified ovoid tooth for a modified type of face will be very much simplified.

With such preparation as suggested, familiarity with the teeth provided by Nature for the pleasing faces of friends and acquaintances and familiarity with the harmonious combinations of teeth and faces which film companies have pronounced acceptable from the standpoint of beauty—not only will the dentist make his selections suitable as to form but as to size as well.

**Mechanical Aids "Help" Most Those Who Do Not Require Such Help.**—The use of mechanical aids such as finders and patented guides

Fig. 187.—A square type of tooth should be selected to harmonize with a square face.

to facilitate the selection of teeth is most successful in the hands of men who by reason of their large experience are able to dispense with such aids.

While the manufacturers find it convenient to card together the six anteriors of a mould designed for the face-form of a given patient, it is only in a comparatively small number of instances that the operator will find these exactly in harmony with the esthetic requirements as he views them. Whatever selection he may make ultimately, he will find it wise to ask himself: "Are the central incisors wide enough? Are they long enough so that they—not the vulcanite—will show when the patient smiles?"

In selecting teeth, the operator should keep in mind that the high lip line which he may have marked upon the wax occlusal rim merely indicates the point at which the median embrasure begins to show. Consequently, the artificial teeth must be much longer than the natural teeth were. The *length of the teeth should not be determined by the length of the patient's face* if shorter teeth make it necessary to show a larger portion of the gums. When the patient's lip is in position as nearly normal as possible, the incisal edge should show more than at the time of setting-up the teeth seems most pleasing to either

Fig. 188.—An ovoid type of tooth is outlined upon this ovoid face.

operator or patient since, after the denture is worn a few weeks, the lip will lengthen perceptibly.

Are the laterals too long or too short? Are the laterals too broad? The lateral of the human female is characteristically narrower than that of the male.

The cuspids are rarely long enough for the centrals and laterals as carded.

The bicuspids carded with a set of twenty-eight teeth or with a set of fourteen teeth are usually too short and the operator will find it a good rule to get "medium" or "long" posteriors, whatever may be the selection of anteriors.

## 4. RELATIONSHIP OF COLOR OF TEETH TO ESTHETIC EFFECT

**Strict Classification of People Is as Difficult as the Selection of a Proper Hue for One of the Classes.**—While various attempts have been made to classify people in such manner as to simplify the selection of teeth with regard to color or shade or hue, and while acquaintance with these attempts may serve the operator in a general way, most of these classifications are necessarily so complicated that their practical helpfulness is very limited. The author prefers to divide patients into two classes, those with light complexions and those with dark complexions. In selecting a suitable shade or hue of tooth for a person with light complexion, a tinge of orange will usually be most harmonious; in selecting a shade or hue for those of dark complexion the blue or gray will usually be correct. In case of a patient decidedly blonde or of a typical brunette, the selection of correct shade or color will be comparatively easy. In instances in which the patient may not be easily classified as dark or light without modification, the selection of a suitable color of tooth will be complicated by a similar necessity for modification of color. The dental hue (shade or tint) should harmonize with facial hue and should as nearly as possible blend with the latter. "Facial hue" as here used includes tint or shade of skin, color of hair and color of eyes.

**Selection of Color Comparatively Easy for Full Dentures.**—The requirements of the full denture prosthetist in his selection of teeth are not nearly so exacting as those confronting the operator who constructs a partial denture and must consequently harmonize the shade or tint of an artificial tooth with that of a natural tooth.

**If Not Too Conspicuous a Tooth Approaches Correct Hue.** A simple method of selection for the full denture prosthetist is to select from the dental hue (shade) guide a central incisor, the hue of which suggests itself as suitable for the patient; the operator holds the tooth in proper position under the patient's lip and asks him to smile. If the operator is able to look at the patient without noting the tooth as decidedly conspicuous, he may properly conclude that it at least approaches the correct hue. Other teeth, either lighter or darker than this one, may be tried until the operator finds one which most nearly blends with the setting in which it is placed.

In looking at the patient, the operator will find that to focus his eyes upon an imaginary point some eight or ten feet behind the patient's head will enable him more easily to get the effect of the face

as a whole, since, then, his consideration of the effect is casual. This method of viewing the total effect avoids emphasis upon any one element through concentration upon it.

If the operator and patient find that the teeth of the hue selected are satisfactory throughout the entire set, these are employed for the case. Otherwise, combinations as suggested on page 74 are used in order to produce the desired effect.

**Color of Rubber Facing Not Important, if Teeth Are Correctly Placed.**—It may be well to add a few words with reference to the color of rubber facing that may be employed. For two reasons, the color of the rubber employed for this purpose is not of great importance. In the first place, if it is employed properly, very little of it is displayed when the patient smiles; in the second place, none of the rubbers available for this purpose does more than approximate in resemblance the natural gum tissue. Only the baked porcelain gum of the platinum base denture succeeds in imitating the natural tissues so as to defy detection as artificial.

**Author Prefers Walker's Granular Gum.**—However, in the choice of rubber for facing, the writer prefers to use the granular gum rubbers (light purple tint) because of the fact that the granular surface reflects the rays of light more nearly as the natural gum tissue does, and consequently with a more pleasing effect. In choosing from the granular gum rubbers available, those should be avoided which tend to disintegrate after a year or more of usage in the mouth; the disintegration results in a rough surface which also becomes spongy and unsanitary. Walker's granular gum facing is not thus subject to disintegration.

## 5. RELATIONSHIP OF MARKINGS—STAINING, GOLD FILLINGS AND IMITATION OF DEVELOPMENTAL CHARACTERISTICS—TO THE ESTHETIC EFFECT

**Characteristic Markings of Teeth Must Be Supplied.** Owing to the fact that the teeth as manufactured are necessarily uniform in appearance and not adapted to the individual requirements of harmony, the operator may often enhance the esthetic effect by grinding or staining or filling some of the teeth. The characteristic markings of the teeth due to age must be supplied by the operator, since the teeth as manufactured are designed for patients of younger years than those who ordinarily require artificial dentures.

**Abrasion and Erosion May Be Imitated.**—Abrasion and erosion may be imitated by grinding out that portion of the tooth corresponding to the abraded or eroded portion of the natural tooth to be imitated. These markings are usually found just below the gingiva and are usually most prominent on the cuspids, less prominent on the laterals, and in small degree on the central incisors; the bicuspids sometimes are thus marked, but for the most part, the cuspids will receive this treatment.

**Method of Marking the Teeth.**—The glazed surface in its entirety is removed from the labial and proximal aspects of the six anteriors and from the buccal and proximal surfaces of the bicuspids and molars, by placing the teeth against a large carborundum stone on the lathe. These surfaces to be marked are ground with a medium garnet disc to smooth out the depressions as desired and at the same time to restore smoothness to the surface thus treated. Three or four discs are ordinarily required for this purpose. A high polish may be given the tooth which has been marked, with the use of a very small (7 mm. wide) hard felt wheel. This wheel may be made by cutting this width from a felt cone 25 mm. in diameter. If the cone is put upon the lathe, a sharp knife may be held against it to cut off a portion of the width desired. Either oxide of tin or a proprietary preparation such as Kerr's Porcelain Polish is used as an abrasive with this wheel.

The removal of the glazed surface will render the teeth susceptible to stains of fruit juices and more difficult to keep clean. On this account, the patient should be advised accordingly, before the operator begins to mark the teeth as just described.

If it is desired to imitate the exposed and stained line of dentine on the incisal surface of the mandibular incisors, the incisal edge of the artificial tooth is cut away with the carborundum stone and then a diamond-charged copper disc or an improvised mandrel with carborundum powder is used to cut the porcelain along the incisal edge to a depth of ½ mm. After the dentures have been worn for a while this line will have become sufficiently stained, without the employment of any special or prepared stain.

Opaque white spots often found on central incisors are easily imitated with the use of white mineral stain.

**Using Mineral Stains.** The markings as suggested may be provided in the case of ordinary Trubyte teeth or any other teeth which do not have platinum pins. If it is desired to stain the teeth by means of mineral stains which require fusing, it is then necessary to employ

teeth which have platinum pins in order to withstand the temperature of the furnace or be careful to fuse the stains below the fusing point of the solder which is employed in the nonplatinum pins. The ordinary pins otherwise are likely to be rendered unstable because the solder which retains them is melted during the fusing process and as a result they subsequently prove unsatisfactory.

If an imitated erosion is to be stained, the glaze is removed from that portion only which is to resemble the erosion. If no more of the glazed surface is removed the porcelain stains will, when fused, give a glazed surface to the portion which they cover. Because of the fact that the porcelain regularly used glazes at a much higher temperature than is required for fusing the porcelain stains, it is impractical to employ both kinds of porcelain at the same time. If used at the same time, the higher temperature will burn out the coloring matter of the stains.

**Imitating the Lines Usually Found on Maxillary Central Incisors.**—In imitating the line which almost invariably is found on the maxillary central incisors of the natural teeth, extending from the incisal to the gingival margin, a diamond glass cutter such as glaziers use is employed to barely scratch through the labial surface. The stain is wiped into the scratch with the finger and all of the excess is wiped off—the operator may rub his finger against the tooth as if intending to wipe off all of the stain and enough will be left to give the desired effect when fused.

**Preparing and Applying Stains.**—A box of eight colors of "mineral stains" prepared by the S. S. White Company will be found to provide all of the results desired in staining. The correct combination for a particular requirement is easily determined by experiment. The "stains" consist of a powder similar to porcelain, colored by mixing with metallic oxides (usually). In preparing the stains for applying to a tooth, the powder is mixed with any one of the essential oils, such as oil of cassia, oil of cloves, oil of wintergreen, etc. It may be placed upon the tooth with a small camel's-hair brush or applied with the tip of the finger. The tooth is then placed in the furnace and at a fusing temperature of about 1600° F. may be removed and placed under a jeweler's cover glass, where it will cool without cracking.

**Filling an Artificial Tooth.**—If gold fillings are to be employed, the teeth should be set up in the wax ready for flasking. Then the tooth to be filled is removed from the alignment and the outline form of

the cavity is ground out sufficiently to provide the desired bulk of gold for finishing down as desired. The cavity is ground so that the margin is the highest part; a carborundum stone either in the handpiece or on the lathe is employed for this purpose. The retention is cut in the porcelain by using the S. S. White's unmounted carborundum point No. 13 (Fig. 189). This may be mounted in the mandrel (Fig. 190) and used in the lathe or in the handpiece. Retention pits are ground in the cavity, keeping the stone wet all the while and occasionally sharpening the point of it by holding it while wet against the side of a large carborundum stone.

**Gold Fillings Enhance Naturalness.** Gold fillings may often be required in order to render the artificial teeth more nearly reproductions of the patient's natural teeth as they appeared for some months before extraction. Some patients will insist upon their use. Whether the patients desire gold fillings or not on this account, it is often wise to suggest that gold fillings do much to enhance the naturalness of

Fig. 189.—In preparing cavities for gold fillings in artificial teeth the S. S. White's unmounted carborundum point No. 13 is used.

Fig. 190.—The carborundum point is mounted in the S. S. White's mandrel.

artificial teeth. Their value for this purpose is, from the author's viewpoint, unquestionably great. This attitude towards their employment assumes that the operator will employ them with an appreciation such as the more skillful operators exercise in the placing of gold fillings in natural teeth. If they are placed in the approximal surfaces and in crescent-shaped cavities near the gingiva, this keeps in mind the fact that decay in natural teeth often requires a filling at these points. Fig. 191 shows the author's idea regarding fillings properly placed in comparison with fillings which can hardly be said to enhance the esthetic effect. They should not appear in the central portion of the labial aspect of a tooth. In fact, a mere suggestion of gold is much more effective than an obvious effort to display a large amount. It is needless to observe that this idea of improving the esthetic effect by a conservative introduction into artificial dentures of such imperfections and attempted corrections as are found in the natural teeth, will not appeal to the individual whose idea of beauty leads him to insist: "I want a gold crown right here in front."

**Fashioning a Mandrel for Cutting a Cavity.**—The cavity may be prepared in the tooth with the use of a less expensive equipment or by means of the diamond-charged copper discs. The less expensive equipment is provided by mounting an ordinary shingle nail in the lathe chuck and by cutting it down with a file held against it while revolving. The head is cut down to a diameter of four or five millimeters and to a thickness of about one-half millimeter. The diameter of the shank is also tapered down to the head from a point on the shank about ten or twelve millimeters distant from the head. With this improvised mandrel mounted in the handpiece or in the lathe the desired cavity is prepared; the tooth is held against the head of the nail and No. 90 carborundum powder mixed with water is used to cut the retention pits. In cutting these the lathe is allowed to run at full speed and very little pressure against the tooth is required. It may be noted that the comparatively soft metal of which the nail is made makes the disc head excellent for the purpose, since the soft metal carries the carborundum splendidly. The carborundum mixture should be very wet at all times in order to secure the best cutting effect.

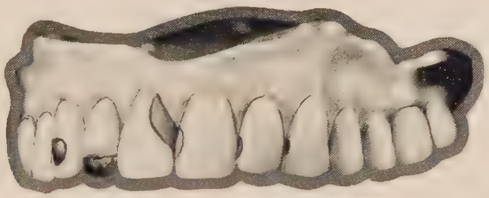


Fig. 191.—If gold fillings are placed in approximal surfaces and in crescent-shaped cavities near the gingiva, this is in keeping with the fact that natural teeth often require fillings at these points. This figure contrasts gold fillings properly placed, according to the author's idea, with fillings which do not enhance the esthetic effect.

**Protecting Tooth Against Breakage While Filling.**—The tooth, after the cavity is cut, is cleaned, freed of wax around the pins, dried and then mounted on the clean bench with S. S. White's black compound or with common sealing wax. As much as possible of the tooth should be encased in the compound or sealing wax, leaving only the cavity exposed. This precaution in encasing the tooth is designed to protect it against breakage when the gold filling is being malleted into the cavity. Sufficient gold is malleted into the cavity to allow enough material for burnishing and finishing. The filling is finished with sandpaper discs, pumice and rouge.

## 6. RELATIONSHIP OF ALIGNMENT OF THE TEETH TO THE ESTHETIC RESULT

**"Perfect" Alignment Not Always Desirable.**—The arrangement of teeth is as important as the selection of teeth of suitable color and correct size in producing the desired esthetic effect. While a "perfect" set of natural teeth is most harmonious and beautiful, their very perfection stimulates and invites a critical observation. Such perfection is not characteristic of the teeth generally seen. Consequently, the prosthetist may often show himself more of an artist through an arrangement of the teeth which does not follow exactly a "perfect" alignment, especially is this true if the patient is not the most perfect type of beauty.

**Anterior Teeth of Proper Length Preferred to Carving of Vulcanite.**—In considering the size of the teeth, it was suggested that for patients who show with their natural teeth much gum tissue while laughing, it is more desirable to select longer artificial teeth in order that teeth instead of vulcanite may show. It seems that some operators fear to expose the necks of the teeth lest the teeth will not be securely attached to the base of the vulcanite. Since there is no stress exerted against the anteriors with a tendency to push them off the base, such fears are groundless. Some operators seek to carve the gum facing in such fashion as to provide esthetically for those who show the natural gums while laughing. No carving of vulcanite can produce an esthetic effect equal to that produced through anterior teeth of proper length. Excessive carving of the vulcanite may serve some purpose in an effort to provide a case for display purposes, but in the patient's mouth it does not equal other methods for enhancing the esthetic effect, and further tends quickly to become very unsanitary.

**Lateral Teeth Slightly Shorter Than the Centrals.** The lateral teeth often may be pushed up until slightly shorter than the central incisors, with a decided increase in the esthetic effect.

In most instances the incisal angle of the cuspids should be ground away to keep them from appearing too pointed.

**Cuspids Should Not Be Too Prominent.**—The distobuccal aspect of the cuspids should be rotated inwardly, since when this is too prominent the patient appears to have "too much" teeth. That is, when the cuspid is too prominent the whole effect is that of a set of teeth which are too prominent.

**Spacing, Lapping or Omitting Teeth May Improve Esthetic Effect.**—Spacing and lapping of teeth in the same mouth is incongruous, although the writer recalls a patient in whom both were found, and the patient also stated that this was a family characteristic.

**When Teeth May Be Lapped or Omitted.**—When a patient's maxillary ridge is unusually large and the face not proportionally large, the anterior teeth of the mould selected may be spaced to advantage. When the maxillary ridge is small and the face not proportionately small, the anterior teeth may often be lapped with good effect. Of course when the teeth of one ridge are lapped or spaced, the corresponding teeth of the other ridge must be aligned to compensate for the lapping or spacing. Instead of lapping the teeth in a mandibular denture, a tooth may be omitted, usually an incisor. If the relationship between the maxilla and mandible is such that there is a pronounced retrusion of the mandible so that the artificial teeth may not be set up in normal relationship in order to improve the appearance, both first bicuspids may be omitted. With this omission the anterior teeth may be set more nearly upon the crest of the anterior portion of the ridge which will also be in the interest of leverage and masticatory efficiency.

## CHAPTER XII

## CAST-SWEDGED ALUMINUM BASE DENTURES

**Superior Character of Aluminum Bases.**—With the exception of bases made of platinum or of gold, the best base upon which the prosthetist may mount artificial teeth is *aluminum*. Aluminum is a good conductor of heat and cold, and accordingly permits the tissues of the mouth to receive the stimuli which vary with the temperature at which different viands are partaken, and which in many instances give to choice dishes their characteristic and more palatable flavor. Aluminum does not contribute to a hyperemia of the tissues through maintaining them at an abnormally high temperature, as is often the case when the area is covered with a vulcanite base. Such abnormal conditions as result from wearing vulcanite dentures is akin to the abnormal and discomforting condition which the hunter experiences in the case of his feet after he has worn rubber boots for a number of hours. One has but to note the normal pink physiological condition of the mouth wearing an aluminum base, in order to be convinced that the superiority of aluminum as a material for denture bases is no imaginary superiority.

**Bacterial Growth Under Vulcanite.**—Only recently tests have been made with metals ordinarily employed in metal base dentures, to determine their relative value in inhibiting bacterial growths which flourish in the mouths of patients who wear vulcanite dentures. W. J. Pryor of Cleveland, Ohio, in a paper read before the American Dental Association in September, 1923, reports the results of tests conducted by himself and others which tend to confirm the fact that any of the metals employed for denture bases is superior to vulcanite. He also submitted the proposition that the increase in temperature under a vulcanite denture is not so much due to the fact that vulcanite is a poor conductor of thermal changes, but "due to a hyperemia caused by the irritating products of bacterial growth."

**Objections Advanced by Older Dentists.**—Many practitioners are obsessed with the idea that the aluminum cannot be as well adapted as the vulcanite. The fact is, that the operator with aluminum is confronted with less shrinkage than in the employment of rubber as a substitute for it. However, the obsession not infrequently results

from experiences with laboratories which do not swedge their aluminum bases down to adaptation upon their original casts, after casting them. Since the coefficient of expansion and contraction is as great as it is in the process of casting aluminum, it can be regarded as scarcely anything but a species of malpractice to attempt to secure adaptation, without swedging in order to compensate for the shrinkage that occurs. If it were possible to alloy aluminum so that this shrinkage would not take place, the necessity of swedging would be eliminated; but aluminum thus alloyed, while it might serve some other purposes very acceptably, could not serve the prosthetist. He could not use it, because in the fluids of the mouth alloyed aluminum would become an element of a galvanic battery in which the presence of the alloy together with the aluminum would result in a disintegration of the latter metal. Such disintegration is similar to that which takes place, for example, in the wet cells in which the zinc and copper elements are immersed in a solution of blue vitriol or copper sulphate.

**Pure Aluminum May Be Obtained.**—On account of this tendency of alloyed or impure aluminum to disintegrate under the influence of electrolytic action, many dentists refuse to have anything to do with the aluminum base, because, they say, that after a few years, it becomes full of small holes. This objection usually is raised by the older men of the profession; and their objections once were well based. Twenty years ago it was impossible to secure aluminum pure enough for the prosthetist's purpose. The manufacturers had not succeeded in eliminating the 2 or 3 per cent of iron and silicon. Today, aluminum of 99.8 per cent purity is obtainable. At that time also, practitioners were accustomed to swedge a 26-gauge aluminum blank between the die and counterdie. In the process, no doubt, a small particle of foreign metal became imbedded in the finished base, and after a short while the electrolytic action mentioned in the above paragraph resulted in the destruction of the denture.

**No Real Difficulty in Attaching Vulcanite.**—Not a few of those who have regarded the aluminum base with favor have complained that the vulcanite draws away from its attachments on the base. It is patent to all who have engaged themselves with these materials that vulcanite and aluminum are not compatible. However, we know that aluminum and tin are compatible. Further, we know that it is almost impossible to separate the tinfoil and the rubber if we neglect to soap the tinfoil before closing the flask for the last time. Accord-

ingly, we began by putting a layer of tinfoil between the aluminum base and the rubber. At the present time, we use a thin layer of weighted rubber (weighted with shavings or filings of tin) instead of the layer of tinfoil formerly employed. It may be observed that the objection as stated is as valid against gold bases as it is against aluminum, and there is never any occasion for the objection in either case, if a sufficient number of grids or ties or retainers are provided.

**Thicker Cast Is Used.**—In making a cast for an aluminum case, the technic as previously outlined in the first chapter of this book, is employed. The cast is made much thicker than when vulcanite dentures are contemplated, in fact, the thickness should approximate the breadth; these dimensions represent the strongest form of solid known to physics, and such form is desired to withstand the stress to which the cast will be subjected during the swedging process. It is unnecessary to pour a metal die, since a stone cast satisfies every ordinary requirement.

**Relief Is Made With Adhesive Tape.**—After the cast is trimmed, the relief over the hard areas is supplied through the use of physicians' adhesive tape cut to shape and size as required by the individual case; this adhesive is attached to the cast, and the edges, as well as any looseness in the texture of the tape, are sealed with a minimum amount of wax. Only a minimum amount of wax should be used; the tape is not intended to provide an air chamber, but to afford a relief only.

**Preparing the Surface of a Cast.**—After the cast has been trimmed, it is then treated with powdered soapstone. Where this is not easily obtainable, a cheap grade of talcum powder serves acceptably. This is sprinkled upon the cast and rubbed in until the cast presents a glazed and polished surface, care being taken to avoid leaving any surplus. The surplus sometimes accumulates in spots, which obviously prevent the modeling compound duplicate impression from being an exact negative reproduction of the cast.

**Making Duplicate Impression.**—The original impression of the mouth is, of course, the most important factor in assuring perfect adaptation of the finished base. The factor next in importance, and the one which the instructor finds somewhat difficult for students to secure, is the impression of the cast. For this purpose, Kerr's Modeling Compound that has been used, if free from particles of plaster, is really better than new compound. It has lost some of its "life," is not so sticky at the same temperature, and is more economical.

## SELECTION OF A TRAY FOR TAKING DUPLICATE IMPRESSION

**Suitable Tray.**--A metal tray suitable for use in taking the impression of a cast should be selected large enough to permit the flanges to rest upon the border of the cast and deep enough so that the tray will not touch the ridges. The flanges may be bent to contour with pliers. Fig. 192 shows a metal tray of proper size. Fig. 193 shows a tray that is too small for the cast. The ridges of the cast touch the tray too quickly and thus make the compound too thin.

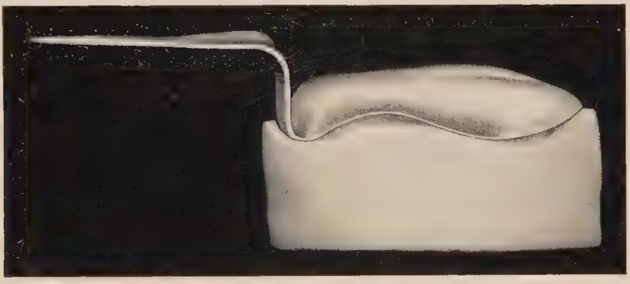


Fig. 192.—Metal tray of size suitable for taking an impression of the cast.

Fig. 193.—Metal tray too small for this case; ridges in contact before flanges rest.

**Impression Must Not Be Too Thin.**—If for the case at hand, the operator has no metal tray with flanges high enough to keep the tray, when pressed entirely down, from touching the ridges, it should not be pressed down so far that it will come into direct contact with the ridge of the cast at any point. There should always be at least a thin layer of compound over every portion of the tray, when the impression is completed. Otherwise, the impression is subject to the possibility of being easily distorted.

**Flanges May Be Made of Compound.**—The lack of flanges of sufficient height to serve properly as containers for the compound while the impression is being taken, may often be supplied by means of compound along the border at any point required. The compound used for this purpose is applied and cooled and then may serve as a container for the softer compound which is used for the outline of the impression. The compound for this purpose is used in the following manner: If, for example, the retaining flange is needed in the anterior portion, the tray is filled with compound and built up to the height at this point necessary to serve instead of the flange; this portion is then chilled. Then, when the surface of the compound is warmed preliminary to taking the impression, it is warmed by means of a chip-blower projecting the flame as desired, but without softening the anterior portion used as a flange, as would probably be the consequence if the surface were warmed over a Bunsen flame.

**Taking the Impression.**—The oversize aluminum tray is filled with compound, which previously has been warmed to proper consistency and kneaded as our mothers were accustomed to knead the last bit of biscuit dough, kneading the wrinkles under so that the surface, which comes into contact with the cast while taking the impression, will be perfectly smooth. After the compound has been placed in position on the tray and allowed to cool until it is too cold to be used for taking an impression in the mouth, the surface is heated over the flame until it has a glazed appearance and all finger prints have disappeared. It is then sprinkled with powdered soapstone or talcum, which, after being smoothed lightly with the fingers, is blown away; it is then pushed down upon the cast, which during the operation rests securely upon the bench. The compound is pressed against the anterior portion of the cast first, and then gradually settled into position towards the heel. When it is fully in place, the cast and tray are held firmly between the fingers and thumb of one hand, while the other is employed to press the excess compound back over the tray in order to facilitate the removal of the cast when the impression is cold. The impression, while on the cast, is placed in cold water; and after being chilled thoroughly, it is separated. Often this act of separating is attended with no little difficulty; care should be exercised to avoid breaking or marring unduly either cast or impression.

**Removing the Impression.**—In removing the impression (together with the metal tray) from the cast, grasp the cast in one hand and place the whole of the other hand over the tray, allowing the base of the palm to rest upon the handle. Then, grasping the posterior

portion of the tray between thumb and fingers, pressure may be directed against first one side and then the other while the handle acts as a lever to aid in raising the posterior portion. As the posterior portion is loosened, the impression is gradually eased forward and off the cast. The impression is now scrubbed in cold water, using for this purpose a vegetable brush and ivory soap. This operation is not so much for the purpose of removing the soapstone as for the purpose of polishing the impression.

**How the Operator May Know Whether the Duplicate Impression Is Correct.**—The experienced operator at the chair knows when he has an impression, which is the desired reproduction of the ridges and adjacent tissues of the patient's mouth. In the laboratory he will know as well when his duplicate impression is correct. His experience tells him. His experience which thus confirms or denies the correctness of results obtained is made up of all of the details of the various cases with which he has dealt, and as such it is impossible for him to pass on to another operator this experience and ability to judge. However, he may enumerate certain precautions that must be taken and he may mention specific elements or phases or standards which must be kept in mind, and which ordinarily are sufficient to determine the success of an operation.

He knows that the duplicate impression is correct if:

1. It discloses clear details throughout, that is to say, if the cast has pronounced rugae, these will be striking features of the impression; if the cast has a sharp or abrupt border this will be characteristic also of the impression.

2. The surface discloses an even compressed appearance, instead of portions here and there appearing granular.

He knows that the duplicate impression is not correct if:

1. When removed from the cast, the impression shows that any portion of the surface has not been subjected to pressure. Where pressure has been exerted the surface of the impression will have a smooth continuous appearance.

2. Certain sharp details of the cast are not sharp in the impression.

How to Correct Imperfect Impressions:

1. Due to insufficient compound in the tray. If the impression shows that a portion of the compound has not been under pressure, additional compound should be added and blended with the original mass by means of the chip-blower to direct the flame against this portion. It is then sprinkled with powder and pressed to place.

2. Due to the fact that the whole mass of compound was too warm.

If the whole mass is too warm, the impression may stick to the cast. When this happens, the whole mass should be warmed again and a new impression taken.

3. Due to the fact that the surface was not warm enough. The compound will not fill the depressions and general indistinctness of the impression will be the result. An entirely new impression should be taken.

4. Due to lack of confining borders on the tray. Flanges of compound should be provided according to the method indicated in this chapter in a previous paragraph. The impression may then be taken in the usual way.

5. Due to failure in properly filling undercuts of the cast with "cores." If the undercuts have not been obliterated by means of the "cores," the impression may be distorted in removing. It may hang in these undercuts and not only distort the impression, but the cast may be broken during the removal. Cores should be provided as indicated in this chapter, and then a new impression taken.

**Technic of Making Cores.**—When the cases have undercuts, S. S. White's impression tray compound is employed for making cores, which greatly enhance the accuracy of the impression and facilitate its removal. The impression tray compound has a higher melting point than Kerr's compound which is used for the duplicate impression, and accordingly will not be affected by the heat of the larger mass of Kerr's when surrounded by it. The region of the undercut is thoroughly oiled with cocoa butter; the compound is softened and shaped into a cone, the base of which is chilled. The apex of the cone is now forced into the undercut and up to the crest of the ridge as well as slightly over the border of the cast. The excess is trimmed away until about half of the protecting border of the cast is exposed, and the core beveled to the ridge (Fig. 194). As many of these cores may be made as may be necessary to eliminate all undercuts. The surface of these cores should be oiled before the impression is taken. When the impression has been removed, the cores may be taken out of the undercuts and set into their proper places in it. Fig. 195 shows the impression provided with the core.

**Duplicate Impression of Plaster.**—For those who feel that in their hands the use of plaster of Paris will yield more satisfactory results, Figs. 196 to 200 are presented. A sectional duplicate impression is thus secured which for the novice is usually more certain to be accurate than one taken with modeling compound. Following this method, the Austin cast is varnished over the entire surface, after which sec-

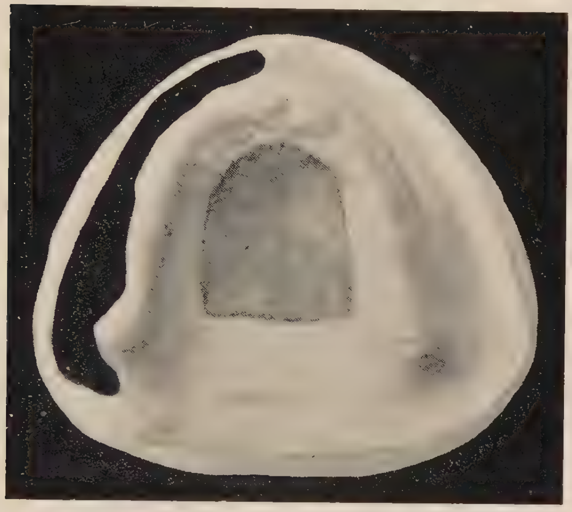


Fig. 194.—Cast provided with core of black compound.

Fig. 195.—Modeling compound duplicate impression into which core has been transferred.

tions of the plaster of Paris impression are built up around it in such fashion that when the sections are reassembled, they will interlock to give a compact impression. The sections are poured as follows: From one tuberosity to the median line constitutes one section; it covers the

crest of the ridge and extends downward to include the Austin cast, forming a section eighteen or twenty millimeters in thickness (Fig. 196). When hardened, the surface of this segment is coated with thin liquid silex and the corresponding segment of the opposite side is poured in similar manner (Fig. 197). The interlocking feature is provided through beveling slightly, these sections. Viewed palatally, the

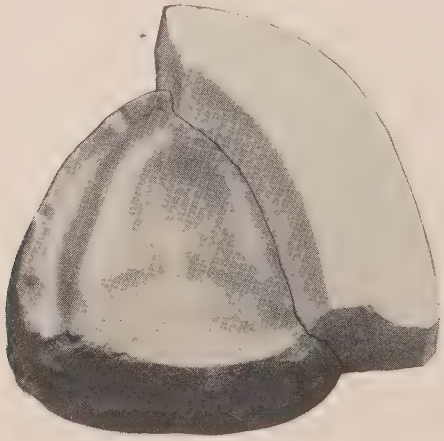


Fig. 196.—Austin cast with one section of plaster duplicate impression.

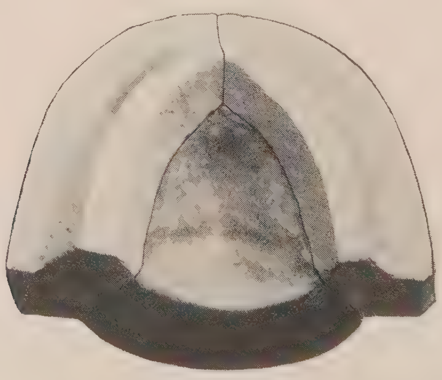


Fig. 197.—Cast with two sections of plaster duplicate impression.

sections should be beveled outward from the inside and the outside portions should be beveled downward, so as to leave, instead of a sharp ridge, a flat surface six or seven millimeters wide extending full length along the top. These beveled surfaces are coated with silex, and the palatal surface is then poured, allowing the material to cover both the inner and the outer beveled surfaces (Fig. 198), which

thus provides a sectional (Fig. 199) impression that may be reassembled accurately and compactly (Fig. 200). The resulting impression, after being coated with silex, is poured as in the use of compound.

**Investment Material for Cast.**—The investment material used in pouring the duplicate cast should be of good grade. The author has found the formula given in the chapter on Materials very satisfactory and its use economical.

**Making Duplicate Cast.**—The modeling compound impression, which was polished by scrubbing as previously described, *is thoroughly dried*

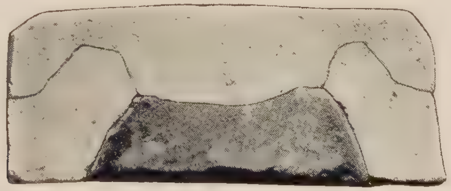


Fig. 198.—Top section of plaster duplicate impression resting upon Austin cast and two side sections.

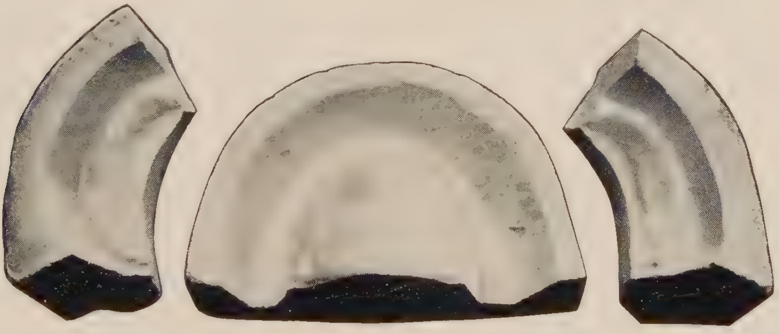


Fig. 199.—The three sections of plaster duplicate impression.

and then poured with this investment material. The duplicate cast thus poured should be about two and one-half centimeters in thickness in order to avoid any tendency to fracture while the wax pattern is being adapted. When the investment material cast is sufficiently hardened, the aluminum tray is removed, after which the compound is removed with the use of dry heat. The cast is trimmed neatly and all loose particles removed which might become incorporated in the wax pattern during the process of adapting. The surface of this cast is then polished with soapstone or talcum powder, as in the case of the original cast.

**Eighteen-Gauge Beeswax Sheets Are Used.**—In making the wax pattern, any wax which, in an open flame, will burn free of residue may be employed successfully. However, S. S. White's thin beeswax baseplate sheets (18-gauge) is the kind regularly used by the writer. This, together with a wax sprue former (Fig. 27) for making wax wires, a spatula, a knife, and a clean sheet of paper upon which to lay these, will constitute the required equipment. If any other wax is employed, which is thicker than desired, it may be run through the gold rolls, after these have been oiled to prevent sticking, and the wax thus made as thin as necessary.

**Technic of Adapting Wax Sheets.**—The wax is warmed slightly over the Bunsen flame and adapted to the duplicate cast, beginning with the palatal surface, taking care not to stretch the wax and make it

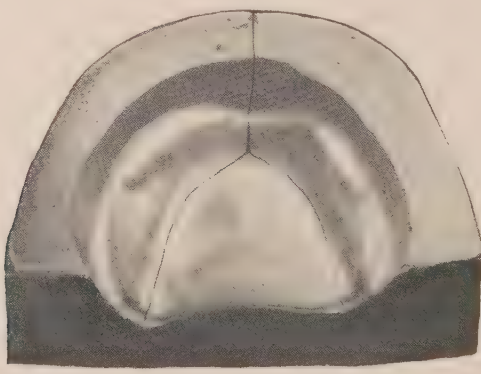


Fig. 200.—Assembled sectional plaster duplicate impression ready for pouring duplicate cast.

too thin. Where it is too thin, the cast will show through with a whitish effect; these places should be thickened, using wax from a hot spatula. The labial and buccal borders of the wax are pressed firmly against the cast and the excess material cut away with a warm knife blade. The entire border of the wax pattern is now sealed to the cast with the use of the hot spatula. A 14-gauge wax wire is expressed from the wax sprue and wire former and, beginning at the posterior buccal border, it is laid against the wax pattern and brought over the crest of the ridge at a point about six or eight millimeters from the posterior border; it is then carried along a line that would represent the gingival border of the natural teeth on their palatal aspect. This wax wire terminates on the opposite side of the cast in a fashion symmetrical with the contour of the beginning side. Formerly, the author continued this wire along the labial and buccal

peripheral borders, but the resulting castings cannot be swedged to adaptation at these points so readily, when these borders are thus thickened. The wire in position, as described, is sealed along the palatal surface of the wax pattern in such manner that it becomes an integral part of the palate. It should be sealed lightly also along the buccal and labial aspects. The palatal surface should then be made as smooth as possible by projecting a flame against it very lightly with the chip-blower. For this purpose, a yellow flame is best; the smaller the flame, the less likelihood there is of melting the wax too much.

Fig. 201.—Finished cases showing arrangement of attachments for vulcanite.

**Attachments for Vulcanite.**—Wax wires (20-gauge) are placed upon the lingual border, bridging over to the crest of the ridge and appearing in the finished base, as shown in Fig. 201. The buccal and labial borders are furnished with a different kind of attachment so that these borders may remain thin and thus lend themselves to an easier adaptation to the cast. These attachments are made through the use of short pieces of wax wire, three millimeters in length, attached to the wax pattern at intervals of about three millimeters in such fashion as not to interfere with the subsequent alignment of the teeth. Holding the wax wire in the left hand, the operator touches the end of it against the wax pattern, and with the heated spatula laid lightly against the pattern at the point of contact, seals it in position, and then uses the spatula to sever the wire at the desired length. The

ends of these wires are "balled" by using a common pin to which a match is attached for a handle. Of course, this instrument may be made of copper and very much elaborated, but a common pin is equally serviceable and also in keeping with the author's practice of employing simple instruments where the results are as easily and satisfactorily secured. A spatula may not be used for this purpose, because the wax adheres to it instead of melting down upon the wire to form the ball or knob desired.

**Sprues.**—In forming the sprue a piece of wax about eighteen millimeters in width is cut from the end of a sheet, folded lengthwise upon itself, and the open edges sealed together; this is then folded across itself to form a right angle, and the inside corners cut off to bring the ends parallel with, and so that they may be abutted against, the posterior border, where the heated spatula is used to make the sprue a continuation of the wax pattern. An auxiliary sprue wire is made of 10-gauge or 12-gauge wax wire and attached at the crest of the wax roll which forms the border of the palatal surface; the anterior end is attached at a point in the median line and the posterior end is joined to the angle of the sprue. This auxiliary sprue may also be joined to the posterior border of the pattern in the median line, using a short piece of this same wax wire. Care must be taken to seal the sprue to the portion of the duplicate cast that extends beyond the wax pattern, in order to avoid forming any crevices that will fill with investment, and which, when the burning out process is finished, will leave spines of investment for the inrushing metal to break down and carry into the interior of the mould, thus resulting in an imperfect casting.

**Cast Is Trimmed.**—The duplicate cast is trimmed to size for the cow-bell flask so that when invested the sprue will rest slightly below the open end of the bell. All exposed portions of the duplicate cast are now trimmed to present a clean surface in order to assure a close union with the fresh investment.

**Investing.**—After spraying the wax pattern with a solution of equal parts of ether and alcohol for the purpose of removing the greasy film left upon the surface as a result of handling, the cast with the pattern upon it is submerged in a pan of water to allow it to become thoroughly saturated, that it may not extract moisture from the new investment material with which it will be surrounded. The holes in the base of the cow-bell are sealed with pieces of wax and the inner walls of the bell moistened with water.

Sufficient investment material (the same as that out of which the duplicate cast is made) to fill the cow-bell is mixed to a thick creamy

consistency. The duplicate cast carrying the wax pattern is removed from the water and the excess blown off; it is then pressed into the investment, lifted out and the material which adheres is jarred to place against the edge of the bowl, while the pattern is held in a horizontal position. This operation is repeated until the entire surface of the pattern is covered. The remaining investment is poured into the bell until it is about three-fourths full; now, with the left hand holding the base of the bell against the bench at an angle of forty-five degrees, the cast, held in the right hand, is brought down vertically into the investment until the cast (not the pattern) touches the side of the

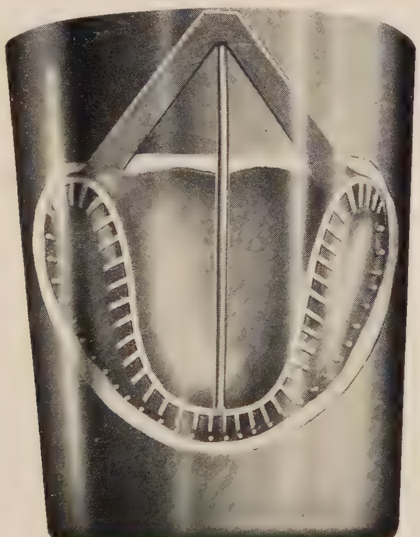


Fig. 202.—Position of cast and wax pattern when invested in the cow-bell flask.

bell, when it automatically assumes under further pressure a position parallel with the sides of the bell flask. The cast is supported with the right hand while the flask is jarred to enable the pattern to settle until the end of the sprue is slightly below the open end of the flask; the jarring is continued until the fingers are entirely withdrawn. Fig. 202 shows this position.

**Forming the Crucible.**—At the end of three or four minutes, the investment will have hardened sufficiently so that a crucible may be scraped out. A large vulcanite scraper is used for this purpose (Fig. 203). This crucible is shown in Fig. 204. It should be cut down until the main portion of the sprue appears in the bottom of it; it should

then be widened in ovoid shape until the sides are within one centimeter of the sides of the bell flask. Sufficient investment is cut away near the holes in the sides to admit easily the hooks of the casting chain. The crucible is now washed in running water to remove any loose particles. It is then inverted over a low gas flame or placed in the electric furnace to burn out the wax.

**Making Cow-Bell Flask.**—The cow-bell method of casting aluminum bases was originated by the author early in 1908, subsequent to Dr. Taggart's announcement of his method of casting gold in January of

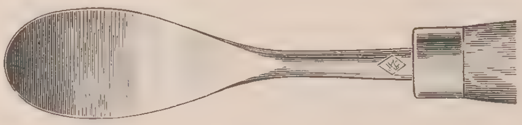


Fig. 203.—Vulcanite scraper used in forming crucible.

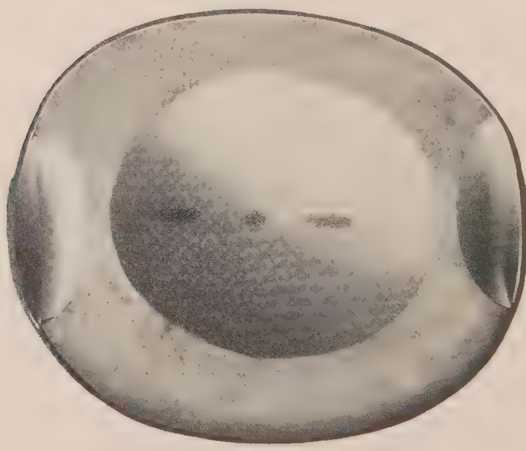


Fig. 204.—Crucible for holding molten metal.

the same year. The flask in which the case is invested for casting is a No. 4 Hoosier cow-bell. This is supplied with a brass safety chain to use in swinging it. The cow-bell as it comes from the hardware store is adapted for this purpose in the following manner: The strap of the bell is held in a vise and pulled off; the head of the rivet that holds the clapper is filed off, the clapper driven out and the bottom straightened with a hammer. Near the mouth of the bell on each of the narrow sides a small hole is drilled to receive the hooks of the chain. These hooks are made of baling wire, and about six inches from the loop in the chain, which serves as a handhold, the links are

bound together with a smaller piece of wire. With the chain fastened in this way, the bell is prevented from tipping and spilling the molten aluminum. Fig. 205 shows the cow-bell casting apparatus complete.

**Casting the Metal Base.**—If the cow-bell flask is placed over a large gas burner in order to burn out the wax, it is permitted to remain at low heat until the wax begins to flow, after which the flame may be increased as much as possible so as to shorten the time. When no discoloration remains around the sprue opening—usually a carbon deposit forms about the opening during the escape of the burning wax—the flask is removed from the flame and placed against a vulcanite flask or soldering block for support while the hooks of the


Fig. 205.—Cow-bell casting outfit complete.

casting chain are inserted. The ingot of aluminum which has been heating alongside the flask over the flame is now placed in the improvised crucible and a sufficient amount melted with the torch. An ounce of aluminum is usually enough for the largest case. This is melted with a blowpipe flame using acetylene or "Prestolite" together with compressed air (see Fig. 206). Where compressed air is not easily available, the writer has found that the Torit Laboratory Torch No. 36, which uses acetylene only, is most acceptable. It is manufactured by the St. Paul Welding & Mfg. Co., St. Paul, Minn., (see Fig. 207). When the aluminum has assumed a rose-red appearance, the torch is shut off, the chain adjusted to balance properly

when held in the hand, and the operator steps to the center of the room and with his arm extended makes a full-arm swing, similar to that which boys employ in swinging a pail of water. If the aluminum is permitted to get too hot, the casting will have an oxidized appearance. However, this oxidation may be removed later with a pledget

Fig. 206.—"Prestolite" and air outfit manufactured by Kansas City Oxygen Gas Company.

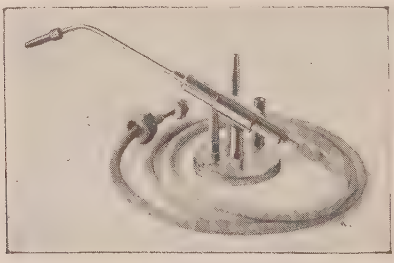


Fig. 207.—Torit Laboratory Torch No. 36, which uses acetylene only.

of cotton saturated with hydrofluoric acid. If the mould is allowed to become too hot before casting, the resulting base may not be of even thickness. The swinging movement is continued until the metal has thoroughly crystallized; this continues the pressure and maintains a uniform shrinkage. The flask is then allowed to cool for a few minutes before putting it into water.

**Elgin Casting Appliance With Moore Flask Recommended to Those Who Prefer Vacuum Method.**—For those who prefer to employ the vacuum instead of the centrifugal method, the author recommends the Elgin vacuum casting appliance (Fig. 208) with the Moore flask (Fig. 209). The latter is fitted with a perforated and hinged inner flask in which the pattern is invested. This provides for the escape

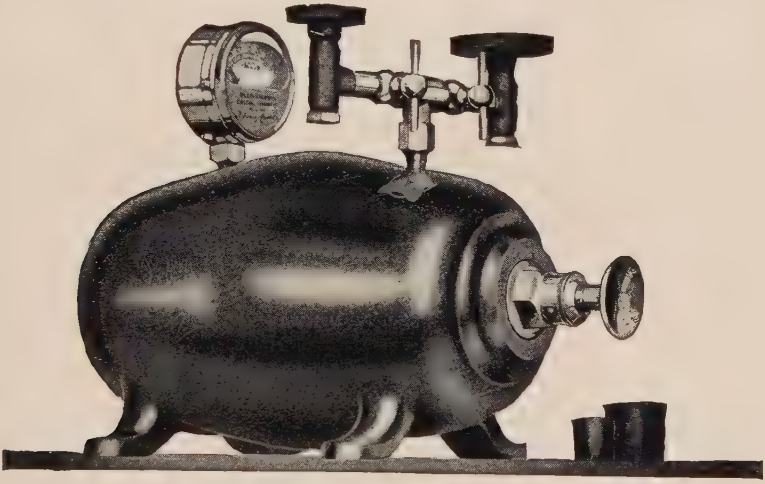


Fig. 208.—The Elgin vacuum casting appliance.

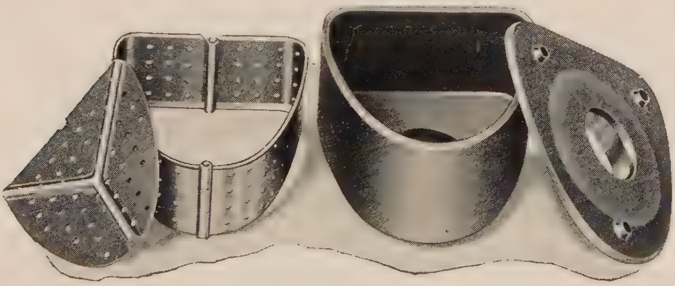


Fig. 209.—The Moore flask.

of all air in the mould cavity under vacuum, and at the same time permits an even distribution of heat to all parts of the investment. Danger of warping or cracking the mould is thus obviated and an inevitable defective casting is avoided. Fig. 210 is intended to illustrate the movement of the air in evacuating under pressure. The Ransom & Randolph Co., of Toledo, Ohio, are the manufacturers. The wax pattern is prepared just as in casting by the centrifugal method, except that the sprue is placed so that the pattern may be

invested horizontally instead of vertically. Instructions accompanying the apparatus fully describe its use.

After taking the casting from the flask, all investment is removed except that which lies beneath the grids or attachments; this is allowed to remain until the swedging process is completed.

With heavy plate shears the sprues are cut off and any surplus

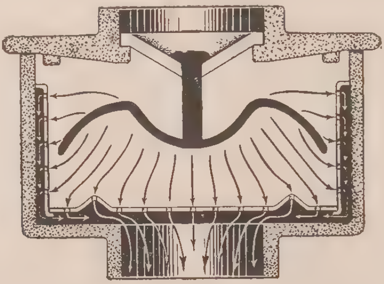


Fig. 210.—Illustrating the movement of air evacuating under pressure.

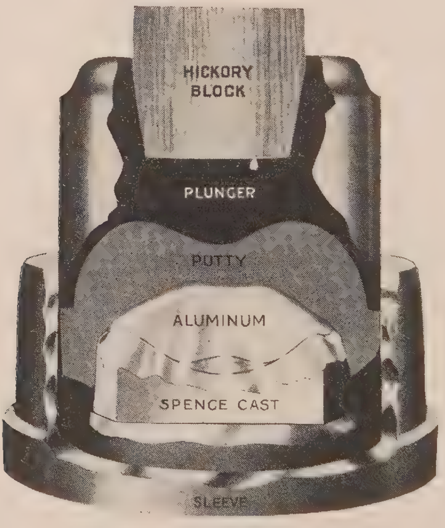



Fig. 211.—Putty swedger.

metal along the border is removed with the use of abrasive sandpaper wheels. The intaglio is examined and any beads of aluminum are removed with a small vulcanite scraper.

**Swedging.**—The casting is now forced upon the original stone cast, and using a horn mallet and a soft pine stick, the periphery is swedged and burnished and special attention is given to the posterior portion. After this preliminary adaptation, the base, in position upon

the cast, is covered with a piece of rubber dam, put into the putty swedger (Fig. 211), and swedged with one blow from a fourteen-pound sledge hammer. A more effective method of delivering the blow for swedging is now employed[1] by the author. A pile-driver with a fifty-pound weight is used (Fig. 212). After this blow is struck, the case is removed from the swedger and examined; in cases which require further swedging the blow is repeated, but in no in-

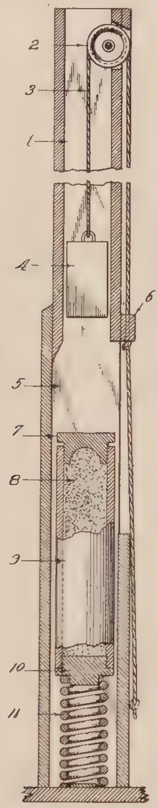



Fig. 212.—Pile driver used in swedging: *1*, box is made of inch lumber; *2*, pulley, 4½ inches in diameter; *3*, ½ inch Manila rope; *4*, 50-pound weight; *5*, opening where swedger is inserted; *6*, stop for suspending weight; *7*, top cap of sand anvil; *8*, sand; *9*, retaining wall of anvil; *10*, bottom cap of anvil; *11*, spring to absorb blow.

stance should the case be struck a second time without previous examination to make sure that the cast has not been injured.

After removing from the cast, the base is further polished with cloth wheel, felt cones and pumice. A stiff vegetable brush and soda ash, or some one of the commonly used household cleansers, are used to scrub out the investment from beneath the grids and to cleanse

the base. In order to provide a definite line against which the vulcanite may be finished, a small coarse carborundum stone on the lathe is employed to finish to a clear cut edge the palatal aspect of the line which gives design to the palatal portion of the base.

**Metal Bases Are Packed with Weighted Rubber Next to the Metal.**—The base is then supplied with a wax occlusion rim. The technic from this stage is similar to that described in the first chapter in the case of vulcanite dentures up to the point at which the case is packed with rubber. An aluminum base is packed with weighted rubber next to the metal; this rubber is used as thin as possible, and as in Fig. 213, over the surface to which the ordinary base rubber is to be attached. The matrix portion of the flask is packed as usual and then a piece of the cloth from which the starch has been washed is inter-

Fig. 213.—Weighted rubber is placed in contact with a metal base.

posed between the two portions and the flask is closed; subsequent steps are the same as those indicated with vulcanite bases.

**Etching and Burnishing.**—After the denture has been finished and polished, the intaglio is etched with *hydrofluoric* acid, which is applied with a small pledget of cotton upon a match. This is neutralized by washing with soda and then is washed in clear water. Finally, both the intaglio and reverse surfaces are burnished with a tantalum ball burnisher using equal parts of bay rum and sweet oil as a lubricant. This burnishing serves to render the surface of the aluminum more dense and thus renders it more sanitary, and makes it more easily cleansed by the patient.

**Specific Gravity of Aluminum.**—Contrary to the impression that aluminum bases are lighter than other kinds, the specific gravity of aluminum ranges from 2.5 to 2.7, while that of vulcanite is from 1.15 to 1.75.

## CHAPTER XIII

## CAST-SWEDGED GOLD BASE DENTURES

The gold base denture is second only to the platinum base continuous gum denture. When esthetic requirements of a case do not make the porcelain gum imperative, gold base dentures satisfy every demand, except that of the individual whose sense of well-being prompts him to insist upon the best that prosthetic art can supply.

**Desirable Features of a Gold Base.**—In addition to the thermal stimuli afforded by a gold base denture, it is characterized by the ease with which it may be kept clean; it does not quickly tarnish, and because of gold's greater density, it may be much thinner than one of aluminum. The prosthetist often will find that a prospective wearer of gold base dentures may view their weight as an objectionable feature. As emphasized in the chapter on "Physical Factors," the maxilla has no sense of weight such as the hand and arm possess, but the anatomical structure of the oral cavity makes it possible to construct a base of gold for the mandibular denture in which its weight would be objectionable.

**The Cast Is Provided with a Relief Made of Adhesive Tape.**—The cast to which the gold base is to be adapted should be poured of Healey's artificial stone or a material of equal quality, in order to secure the strength required during the swedging process. For the strength desired, the thickness of the cast should be approximately the same as its length or breadth. Since a relief is required in practically every case the author supplies every cast used for metal bases with one made of physicians' adhesive tape cut to proper size and shape as described in Chapter XII, ("Cast-Swedged Aluminum Base Dentures"); this is sealed to the cast with a minimum amount of hot wax from the spatula. As a precaution to prevent the wax sheet of the pattern from sticking to this wax when the indirect method of casting is followed, the relief may be oiled very lightly with white vaseline.

**Experience in Casting Aluminum Is Helpful.**—Mastery of the methods employed in casting aluminum bases will qualify an operator for surer results in casting gold ones. The wax pattern for an aluminum base is less delicate, greater thickness of the resulting casting is

not objectionable, the metal melts more quickly, does not cool so rapidly, and a slight delay in swinging the mould does not result disastrously.

**Direct and Indirect Methods of Casting.**—While gold bases may be cast with either the direct or indirect method, the author prefers the direct, which is the same as that employed by him in casting aluminum bases. While occasionally he employs the indirect method—in cases which present a comparatively smooth surface and no undercuts—the direct method as employed by him secures consistently better adaptation and more accurate reproduction of details. Harry E. Holaday, Kansas City, Mo., produces beautiful castings with the indirect method; while using the same materials for investing, the proportions vary slightly; he employs the pressure principle as made effective with the Hall Casting Machine.

**The Sprues Constitute Only Difference in Wax Pattern.**—With the exception of a variation in method of providing auxiliary sprues, the wax pattern is constructed in the same manner, whether it is to be used with the direct or indirect method of casting.

In making an entrance for the molten metal, the wax pattern is supplied with a single flat sprue; the character of the investment is such that no provision is made with sprues, or otherwise, for vents or air escapes. This sprue is placed so that the mould remains in a vertical position during the casting process; it is attached either to the palatal portion or to the anterior portion of maxillary patterns; in the case of the mandibular pattern, the sprue is attached at any point which adds convenience in investing, but regard for the laws of physics is shown by the operator who places the sprue to enable the gold to flow along lines of least resistance.

**Removal of Wax Pattern When Employing Indirect Method.**—In preparing the wax pattern, a sheet of Kerr's casting wax, No. 28, is warmed by holding between the palms of the hands. During the winter months it is often advisable to place both cast and wax sheet in warm water in order to facilitate adaptation without danger of sticking; warming the wax increases its adaptability, while saturating the cast minimizes adhesion. The wax sheet is adapted to the cast by means of fingers and tongue, exercising caution to avoid stretching or breaking the sheet. During this process, the wax should be removed one or two times to eliminate danger of sticking to the cast when the pattern is finally completed; if the cast has no pronounced undercuts, the pattern may be removed without difficulty. In cases

presenting deep undercuts, the pattern may be removed through slightly bending out the wax at these points sufficiently to disengage it—compensating through swedging for any distortion that may occur at this stage in the construction of the pattern. By submerging the cast and pattern in cold water, the operator may avail himself of the action of capillary attraction through which the water will separate the cast and pattern without the difficulty that sometimes may be experienced in using the fingers alone. The separation will be encouraged through allowing a stream of water from the faucet to play upon the submerged cast and pattern, thus driving the water in the direction already taken by it as a result of capillary attraction. After returning the partially completed but already well adapted wax pattern to the cast, the surplus wax which has been allowed to

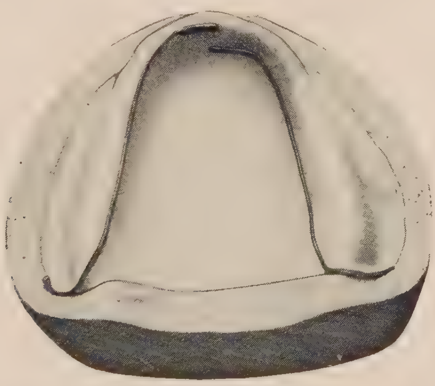


Fig. 214.—The beauty of a case will be enhanced through carefully designing the palatal outline. The wax wire on the left border appeals to the author; the one on the right does not.

remain in order to facilitate removal, is trimmed away with a sharp knife blade, which is moistened and warmed by holding it momentarily in the mouth. In trimming the periphery, the operator cuts the wax either at the extreme outer edge of the roll, or half way between this outer edge and the crest of the ridge, depending upon whether he desires the border of the finished denture to be of gold or of vulcanite.

**Designing the Palatal Outlines.**—Using the No. 1 sprue opening of the Marthew's Sprue Former shown in Fig. 27, a wax wire of approximately 18-gauge is obtained for providing a definite contour on the palatal surface. The position and size of the tuberosities determine very largely the position this wire shall assume in cases which reveal any degree of esthetic appreciation on the part of the operator.

The beauty of the case will be greatly enhanced through a careful designing of this border, and this, too, without in the least minimizing the practical value of the denture. This wire is usually placed too far below the ridges, because the average operator is fearful that it may interfere with the subsequent alignment of the teeth and consequently places it entirely too far from the crest of the ridges. In Fig. 214, the wire on the left, because of its carefully contoured effect, appeals to the author; the one on the right is angular and shows little evidence of design. The border wire of the palatal surface is allowed to extend directly over the tuberosity and beyond, until it terminates in the posterior buccal border. There is no benefit secured through permitting this wire to continue along the peripheral border

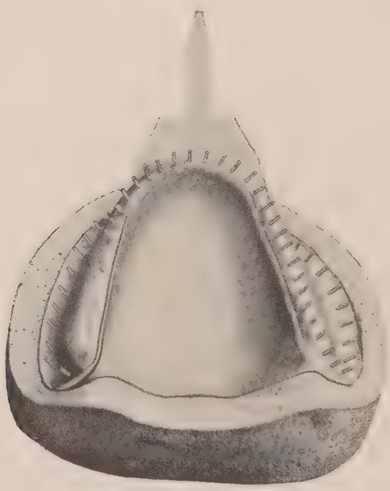


Fig. 215.—Wax pattern on duplicate cast ready for casting by direct method. The spine-like attachments, after casting, will be melted down with the blowpipe; the resulting ball very greatly increases retention of the vulcanite.

of the base; on the contrary, this should not be permitted, because, when it occurs, the rigidity of the border is increased until it interferes with close adaptation at the time of swedging.

**Attachments for the Vulcanite.**—After placing the palatal border wire in position, it is sealed along the inner or palatal edge with a minimum amount of wax and the outer edge is left untouched. With the 18-gauge wax wire, retainers are made for attaching the vulcanite. These are made by holding the wax wire against the pattern and touching both pattern and wire at point of contact very lightly with a hot spatula; this attaches the wire and it then may be severed at the desired length with the next movement of the spatula. These

should be placed at intervals of three millimeters along the inside of the ridge just outside of the palatal border wire, and also close along the peripheral border, allowing just space enough for finishing (Fig. 215). The wisdom of supplying these retainers in large numbers is verified by the results of several years of experience during which the number has been increased very greatly. Their value is also greatly increased through the use of the blowpipe after the base has been cast; further reference will be made to its use for this purpose.

**Sprue with Direct Method.**—In making the sprue, two thicknesses of the No. 28 Kerr's sheet wax are employed; the width varies since this is determined by the size of the case; it is conformed to the

Fig. 216.—The wax pattern removed from Healey cast ready for investing preparatory to casting by the indirect method. Auxiliary sprue wires may be supplied in order to preserve rigidity of wax pattern rather than to supply any requirement in casting.

wax pattern and extends from the region of one cuspid to that of the other, if attached to the anterior portion, or from tuberosity to tuberosity along the palatal border. The free end is shaped to provide a guide in cutting the crucible; a ten millimeter length of it is made smaller than the main portion which should extend at least fifteen millimeters from the closest point of attachment to the pattern. In cutting the crucible, the operator stops the floor of the crucible upon reaching the main portion of the sprue.

**Reinforcing Wax Sprue Wires Used with Indirect Method.**—The sprue used in casting with the indirect method is reinforced with a

number of auxiliary wax sprue wires, which are attached along the posterior palatal border; these extend as follows: one from the posterior border (of the wax pattern, not of the wax sprue) to the center of the palatal portion, one to the crest of the anterior portion of the ridge, one each to the bicuspid region on the buccal aspect of each side, and one each to the cuspid region on the palatal aspect of each side (Fig. 216). The auxiliary sprue wires preserve the rigidity of the pattern rather than serve any real demand in casting the metal.

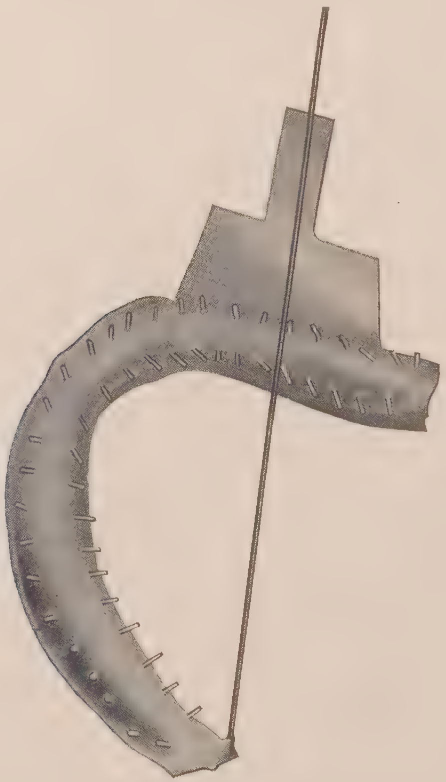


Fig. 217.—Pattern of mandibular base ready for casting by indirect method. A wax-covered piano wire, extending from point of main sprue attachment to the opposite ridge serves to preserve rigidity of the pattern, until it is invested.

The mandibular pattern is strengthened with a length of wax-covered piano wire (not over 20-gauge, when covered), extending, from the point at which the main sprue is attached, to the portion of the ridge opposite (Fig. 217). When the crucible is being cut, the wax cover enables the wire to be withdrawn easily.

**With Direct Method, the Duplicate Cast Is Moistened Before Investing.**—In preparing to invest according to the direct method of

casting, the surfaces of the duplicate cast which are not covered by the pattern should be moistened lightly, in order to assure a closer intimacy with the surrounding investment which is of the same material. In moistening this cast, the operator may hold it in the palm of one hand and with the other apply water along one side; as this enables the water to penetrate the cast slowly from one side, the air may escape through the unmoistened portion without tending to unseat the wax pattern. It is desirable that the wax pattern be constructed within a short time after the duplicate cast has been made; this prevents the cast from drying out and tends to make the invested duplicate cast an integral part of the investing material surrounding it, and practically eliminates distortion of the mould which might otherwise result.

**With Indirect Method, the Wax Pattern Is Chilled.**—Following the indirect method, the wax pattern, when removed from its cast for the last time, is placed in cold water while the investment material is being mixed. Chilling the pattern insures its rigidity while being invested.

**Investing.**—A sufficient amount of investment (the same as used for aluminum cases, formula given in Chapter XIX) is mixed and a camel's-hair brush used to paint the intaglio full, as the pattern lies in the palm of the hand. It is then turned and the other side coated in like manner, care being exercised to avoid air bubbles and to avoid disturbing the spine-like attachments. The No. 4 Hoosier cow-bell, which is used as a flask, is filled about two-thirds full and the investment-covered pattern is then laid gently upon the side of the bell as it is tilted over to receive it; the bell is jarred gently and brought to an upright position as the pattern is gradually submerged. More investment is poured in until it is piled up even with the mouth of the bell flask. A large vulcanite scraper is used to cut out a crucible in the mouth of the flask large enough to receive thirty-five or forty pennyweights of molten gold. The crucible should be cut with well-defined walls; a shallow crucible with sloping walls does not prove so dependable in confining the molten gold during the centrifugal motion. The holes in the side of the bell are now cleaned out and space in the investment provided in order to give freedom for inserting the hooks of the chain (shown in Fig. 218).

**Wax May Be Burned Out or Boiled Out.**—If the operator prefers to boil out the wax from the mould, it is now allowed to dry until thoroughly set. It may then be placed in boiling water or in cold water which is allowed to heat to boiling temperature at which it is

continued for ten or fifteen minutes, depending upon the size of the pattern. When the laboratory is comparatively large, the odor will not be objectionable and the time required may be shortened more

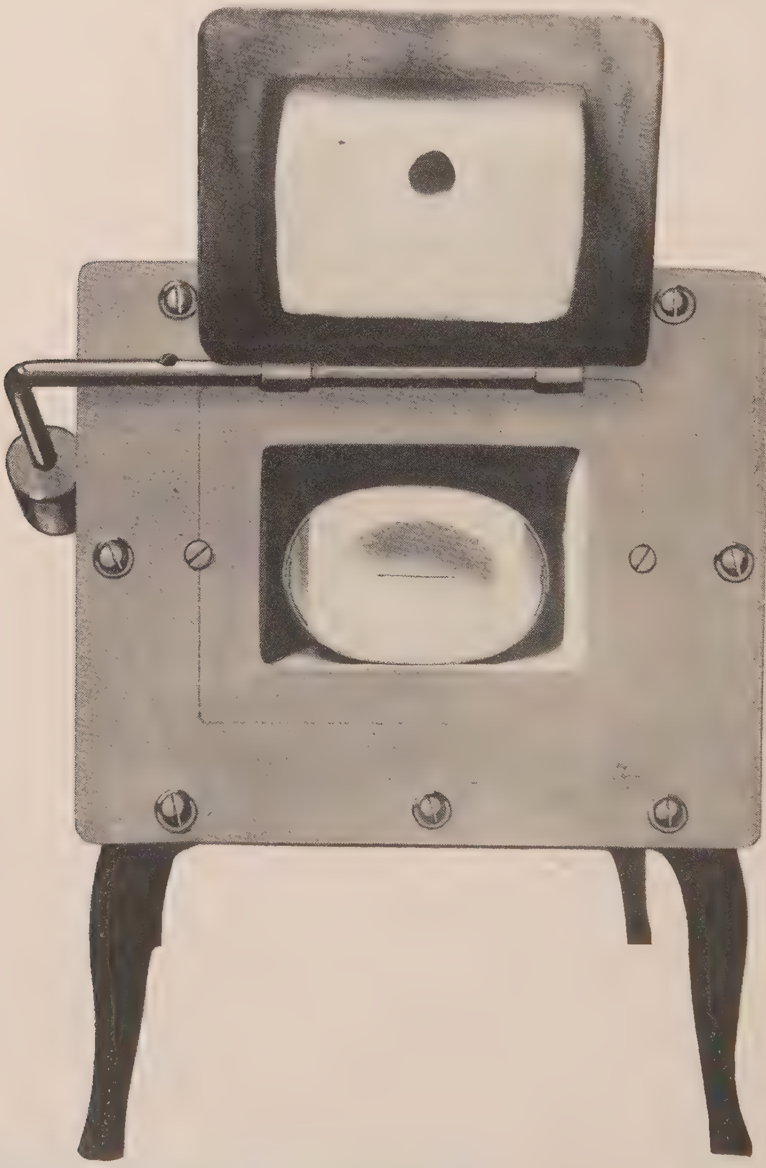


Fig. 218.—The holes in the sides of the bell flask are cleaned out and space in the investment provided for insertion of the hooks of casting chain. Flask is shown in the Hoskins (Type FA) Electric Furnace. (Hoskins Manufacturing Company, Detroit.)

than an hour by burning out the wax. In the burning out process, the case, immediately after the crucible is cut, is placed in the Hoskins (Type FA) Electric Furnace (Fig. 218), or in any other furnace of similar size and character; the switch is turned, and the door left open so that the melted wax may fall upon a paper spread in front of it; when the wax ceases to run, the case is placed in the center of the furnace and the door closed. The door may be opened at intervals to note the progress of the case. At the end of forty-five minutes the operator will detect through the slit in the investment which provides the sprue opening, a reddish glow within the interior of the mould; at the first appearance of this glow, the case is removed and supported in upright position on the bench ready to receive the gold.

**New Gold Is Recommended.**—The 20-karat gold which previously has been melted into a nugget and cleaned, is now placed in the crucible and melted with the acetylene and air blowpipe. Where a refiner is easily accessible, best results will prompt the operator to use new gold each time. However, where this is not convenient, gold that has been used may be melted into a nugget and while under the flame may be sprinkled with a mixture composed of equal parts of powdered borax and saltpeter, or better, since the fumes are not so offensive, Ney's Oxidizing Flux may be used; with the use of a slate pencil, the molten metal may be stirred until it is thoroughly cleaned.

**Casting.**—The button of gold is placed in the crucible of the bell flask and after the brass safety chain has been adjusted so that the flask will balance properly when lifted, the gold is melted with the blowpipe. Upon reaching the casting point, the flask is lifted to a position where it may be held with the right hand, while the left is used to direct the flame upon the button. When the gold approaches a bluish white color, the blowpipe is laid aside as simultaneously the bell flask is swung in a circle at full-arm's length. While undue haste is unnecessary, there should be no loss of time sufficient to permit a cooling of the metal to any appreciable degree. If the button was not made of new gold, reducing flux should be added while melting.

**Kind of Flame.**—Amber or smoked lenses should be worn to protect the eyes from the intense glare of the flame. Much has been written and said by advocates of various combinations of air, acetylene, oxygen, hydrogen, natural and artificial gases projected through blowpipes of various designs; the author, although having tried every combination that seemed to him to offer any superiority, finds that the simple No. 27 blowpipe (Fig. 219) introduced several years ago

by the Buffalo Dental Mfg. Co. for use with artificial gas, is entirely satisfactory when used with acetylene and compressed air. The resulting castings yield practical results fully the equal of those produced with the use of other combinations affording a "neutral" flame.

**Either the Cow-Bell or Elgin Casting Outfit Is Used.**—The same casting outfit is used for gold as for aluminum bases; the same investment material is used, although it is mixed thinner than for aluminum bases; circuitous procedure involving more frequent possibility of delays and misfortune is avoided and the kind of investment eliminates the necessity of "gits," "gates," "vents" and similar air escapes.

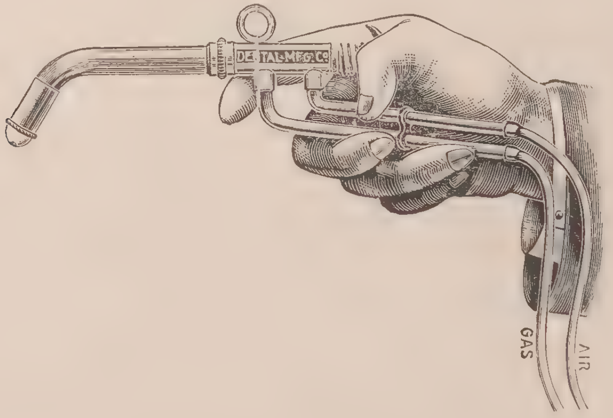



Fig. 219.—The No. 27 blowpipe of the Buffalo Dental Manufacturing Company is used with acetylene and compressed air.

As in the case of aluminum bases, those who prefer the vacuum method may avail themselves of the Elgin outfit and the Moore flask, or some other of the numerous casting outfits which produce excellent results.

**Cleaning and Trimming.** The flask is allowed to cool for a period of fifteen or twenty minutes, or even longer; it may then be placed in water and after cooling, the casting and investment may be removed by tapping the mouth of the inverted bell flask with a horn mallet. After cleaning and brushing in running water, the casting is immersed in hydrofluoric acid to remove all traces of fused silex; it is next washed in a bath of bicarbonate of soda, after which it is washed in running water and then pickled in hydrochloric or sulphuric acid. Any microscopic nodules are removed with the use of

a small, dull, vulcanite scraper; the sprue is cut away with a pair of crown scissors or with a mechanical saw, and any excess removed with a carborundum stone upon the lathe.

**The Vulcanite Retainers Are Supplied with Ball-Shaped Ends.**—The base is now placed upon the soldering block and, after heating the entire base, the wires which are to serve as vulcanite retainers are melted down upon themselves, one at a time, by directing the flame of the blowpipe against each of them until a ball-like end is produced (Fig. 220). When these are finished ideally, the balls are in such close proximity to the base that they resemble gold shot lying upon it. Such retainers strengthen the base, whereas any

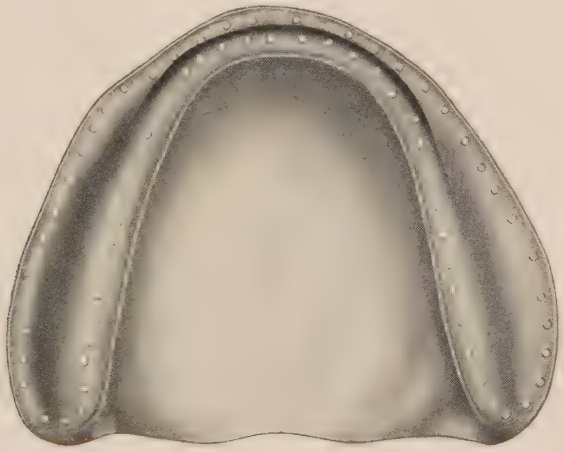


Fig. 220.—Finished base showing ball-like attachments.

method of using holes to aid in mooring the vulcanite has a tendency to weaken the base without providing any comparable form of attachment.

**Swedging and Polishing.**—After placing the base upon the original Healey cast, it is adapted in a preliminary way, especially around the tuberosities and at the posterior border by means of hardwood sticks and horn mallet. It is then placed in the putty swedger and given one blow with a heavy sledge hammer or the weight of the pile driver (Fig. 212) dropped upon it. After removing from the swedger and from the cast, the base is polished with the usual polishing equipment and then a high polish is added with the use of rouge applied by means of a rag wheel. The mandibular base always is swedged *after* it is finished and polished, in order that swedging may correct any slight distortion that may have occurred.

**Providing for a Vulcanite Border.**—If the base is to be provided with a vulcanite border, the following method is employed: After the case has been polished, the cast is very lightly oiled with vaseline in the region to be covered by the vulcanite border, the base is then returned to the cast and the proposed vulcanite border is supplied with the S. S. White's black impression tray compound following the desired contour and allowing it to extend over the retainers (Fig. 221) in order that it may be held firmly, while the base is used as the base of an occlusion model and especially while being tried in the mouth.

With this border of compound provided as described, the occlusion model may be completed as in other cases and then vulcanized with-

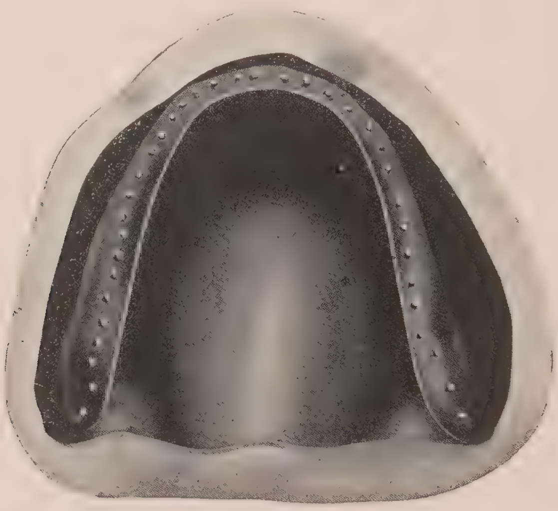


Fig. 221.—Showing base supplied upon the cast with black compound which will be replaced with vulcanite in the finished case.

out the use of the Healey cast. In preparing the case for vulcanization, similar technic to that employed with aluminum bases is followed. When finished in vulcanite, the operator, if required, is enabled to make minor corrections along the border of the denture, without cutting away any of the metal.

**Not a Single Characteristic Favoring Swedged Gold Base.**—The author is unacquainted with a single characteristic of a swedged gold base, entitling it to preference instead of a cast-swedged gold base. The latter has the additional advantages accruing from being more easily constructed and from economy of time in the process.

Before the advent of cast-swedged gold base dentures, the author was accustomed to employ the swedging process alone. Those who for any reason are prompted to employ this process in the present day, may employ the die and counterdie as described in the technic of constructing the platinum base for a continuous gum denture. The author formerly employed 28 gauge, 20-karat plate; a wire (18- or 20-gauge, 20-karat) was used to give an outline to the palatal portion and to provide a line against which to finish the vulcanite. This wire was contoured with the use of 20-karat solder until the palatal contour resembled that which is now obtained in designing that portion of the cast-swedged base. Lugs for attaching the vulcanite were soldered at proper intervals, and a doubler, such as is used on the posterior palatal border of the platinum base, was soldered to serve as a strengthener for this portion of the base. Thinner gold plate may be used and the die and counterdie may be dispensed with by employing two Healey casts, one for preliminary adaptation of the plate and the other for final swedging. A doubler then should be added to strengthen the entire palatal portion of the base.

Technic of repairing gold base dentures is presented in Chapter XV.

# CHAPTER XIV

## CONTINUOUS GUM DENTURES

The platinum base porcelain gum denture is the *ne plus ultra* of prosthetic art; it is the highest product of the artist-prosthetist's skill. It offers opportunity for the full exercise of artistic genius, embodies a genuine appreciation of the esthetic, and gives its wearer the consciousness which accompanies possession of the best.

**Platinum and Porcelain Endure.**—Platinum does not tarnish and in this respect is superior to any gold which may be used for bases; the porcelain is of mineral origin and therefore more enduring than dentures which are dependent upon the vegetable world.

**These Dentures Are Sanitary.**—The porcelain gum is more cleanly than that of other dentures, because its highly glazed surface does not encourage the formation of plaques, while the denture, when properly treated, may be rendered impervious to the fluids of the mouth, thus resulting in one that is highly sanitary.

**The Prosthetist Renders Significant Service to Society in Supplying the Dentures.**—It is almost impossible to overemphasize the prosthetist's service to mankind, since in supplying these dentures, he is able not only to restore beautiful features along with masticatory efficiency, in such manner as to enable the artificial substitutes to defy detection even within close conversational range, but also at the same time assists in transforming timidity into temerity, in banishing embarrassment, in relieving the patient of a consciousness of self, and thus contributes immeasurably to the enjoyment of social intercourse and to a large increase in one's satisfaction in life.

**Enigma in Failure of Dentists to Supply Patients with Better Class of Dentures.**—In view of the character of the materials he is able to supply, the incomparable inspiriting effects upon the patient, and the prosthetist's gratification in being permitted to render the highest service within the scope of his art, it is one of the enigmas of dentistry that few patients learn of the superior merits of these dentures. Few patients come to the office wearing linsey-woolsey or garbed in overalls, yet the majority of dentists insist upon supplying them with the linsey-woolsey quality of dentures. They seem to know nothing but vulcanite.

**Probable Explanation for Lack of Enthusiasm.**—This is probably the explanation: The dentist is not enthusiastic about the surpassing qualities of the platinum-base continuous gum denture, because he is not aware of them; he has no continuous gum case to show to his patient, and he is unable to talk intelligently about its advantages. If he does appreciate the superior merits of this denture, he often fancies that its construction is a formidable and forbidding undertaking, while the truth is that its construction is not nearly so difficult as a great many operators suppose.

**Should Secure Full Advantage of Adaptation, Compression, and Peripheral Seal.**—In taking an impression for the continuous gum denture, the prosthetist should exercise the attention to detail that he displays in taking an impression for any denture. While close adaptation, proper compression of the tissues and peripheral seal are always sought in taking impressions for any kind of denture, the heavier the base, the more imperative the demand that full advantage of all of these factors be secured in the interests of the best retention possible.

**Duplicate Cast Is Made of "Complaster."**—The Healey cast is made in the usual manner. An impression is taken of this cast in order to make a duplicate cast, as described in the construction of aluminum and gold bases. However, the construction of this cast differs from the others in that a different material is employed. "Complaster" is employed. This is a plaster of Paris compound (Dental Products Co., Chicago, Ill.) which includes about one-fourth potato starch. The reason for employing this material is that the starch, insoluble in cold water, dissolves readily in hot water and in dissolving causes the disintegration of the entire cast, which is thus easily removed. Its use enables the operator to construct the mould for a metal die, in one unit rather than in sections.

The "Complaster" duplicate cast is of the exact size in every dimension with that of the desired metal die. This cast is put into a bowl of water to become saturated before it is placed in the soaped metal matrix (Fig. 222) designed by O. H. Simpson, of Dodge City, Kansas. The matrix is then filled with a mixture of crown and bridge investment material (Fig. 223). Simpson employs plaster of Paris, but the author finds crown and bridge investment material (formula on page 362) more satisfactory, since, being more porous, it dries more quickly; it does not crack so easily when heated, and generally maintains a more stable character throughout the various stages of construction

Fig. 222.—A duplicate cast made of "Complaster" in position in Simpson Metal Matrix.

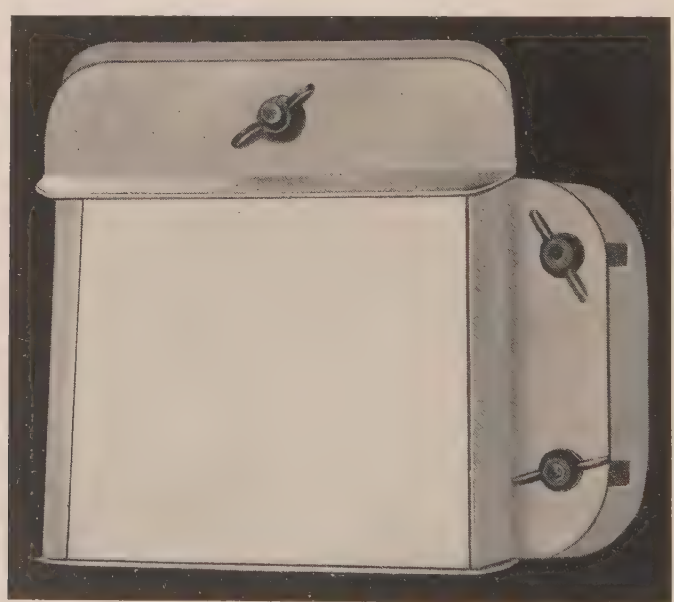


Fig. 223.—The Simpson Metal Matrix filled with crown and bridge investment.

in which it is employed. Fig. 224 shows the "Complaster" cast surrounded by investment, after the metal matrix has been removed. This block of investment containing the duplicate "Complaster" cast

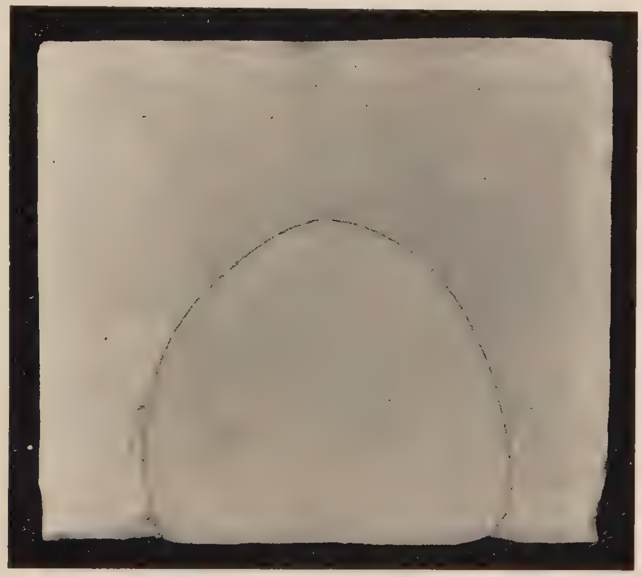


Fig. 224.—"Complaster" cast as incorporated in investment.

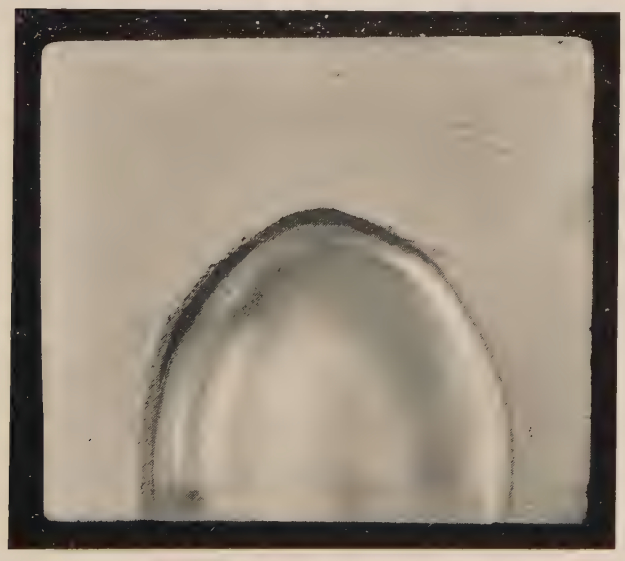


Fig. 225.—Matrix made by dissolving away the "Complaster" cast.

is now placed in a large pan of cold water and allowed to heat almost to the boiling point. It should not be permitted to boil, since this interferes with the easy removal of this material, because the starch is cooked. Fig. 225 shows the investment block after the cast has been dissolved away. Any particles or traces of "Complaster" are rinsed out with cold water. The mould thus formed is soon dry enough to be dusted with talcum powder; the intaglio is rubbed lightly with the fingers and a large pledget of cotton. The talcum should be applied in such manner as to leave a smooth surface; rubbing harshly will

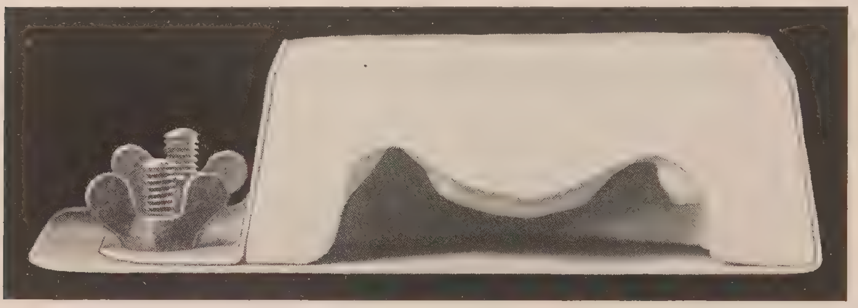


Fig. 226.—Portion of metal matrix employed to complete mould for metal die.

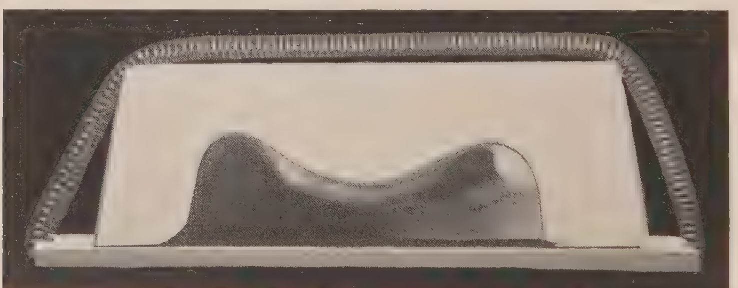


Fig. 227.—Asbestos board is employed with spring as a substitute for portion of metal matrix.

destroy this surface and expose sharp particles of sand, which results in a rough surface on the metal die. The mould should now be placed over the flame and allowed very slowly at first to dry, and then the flame is increased until it is thoroughly dried. A portion of the Simpson metal matrix is now employed to form a portion of the mould (Fig. 226).

**Cardboard and Asbestos Board May Be Used.**—While the use of the metal matrix is very convenient, it may not always be available. In such instances, a matrix may be formed of cardboard. When almost

ready to pour, a piece of asbestos board may be used to complete the mould. Just after the mould is taken from the flame where it has been drying, the asbestos board is wired in place, or a spring may be employed for this purpose (Fig. 227).

**Die Is Poured after Simpson Method.**—The writer prefers to pour the metal die and swedge the platinum base after the method of O. H. Simpson, who stands the mould upon the anterior portion and pours into the posterior palatal opening. This method is preferred because it eliminates the possibility of trapping air in the palatal portion as was the tendency when the mould lay in a horizontal position. Has-

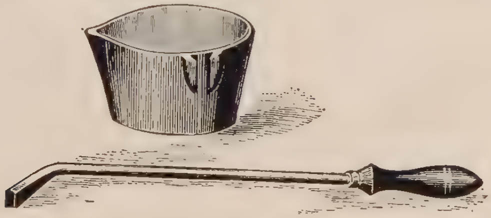


Fig. 228.—Ladle with detachable handle, used in melting Babbitt metal for die.

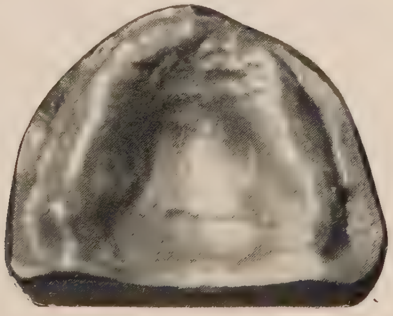


Fig. 229.—Finished metal die.

kell's Babbitt Metal is put into the ladle (Fig. 228), care being taken to avoid pouring while too hot. When the metal assumes a mushy appearance, it is stirred with a soft pine stick as it becomes more fluid. If the pine stick chars, the metal is too hot to pour and should be removed from the flame and allowed to stand until it begins to congeal slightly; then it is poured into the mould and tamped lightly with the square end of the stick used in stirring, and allowed to remain standing until crystallization has taken place. When the mould is opened, any excess is removed with a knife and then the die is polished with the use of a stiff brush-wheel and pumice. The finished die is shown in Fig. 229.

**Exact Tinfoil Pattern Saves Platinum.**—In order to cut the platinum plate without unnecessary waste, No. 60 tinfoil is adapted to the metal die, trimmed to size as if this were to be the base, allowing perhaps a millimeter excess along the entire periphery, and an additional three millimeters along the posterior border. This outline pattern is placed upon 32 gauge platinum plate, which is cut, placed upon the metal die, and with a horn mallet and hardwood burnishers, adapted. In cases of deep vault, it is often necessary to split the platinum in the region of the cuspids from the buccal border and extending over the crest of the ridge; this enables the operator to adapt the metal and avoid its tendency to buckle.

**Counterdie Is Made of Modeling Compound.**—In the construction of the counterdie, modeling compound is employed. The metal die, after being thoroughly oiled, is placed in the bowl of the putty swedger (see Fig. 211, Chapter XII) and a bulk of medium soft compound is forced against it; the plunger is then placed upon the compound and tapped lightly with a hammer to insure close adaptation. When the compound is thoroughly hardened, the plunger, compound and die are pushed through the bowl of the swedger; the die is forcibly removed by inserting a pointed instrument along the posterior border.

**Swedging Between Die and Counterdie.**—The platinum base is now put between the die and counterdie, placed in the swedger and struck one blow with a fifteen pound hammer, or the weight of the piledriver used for this purpose is dropped upon it. This is the only time either die or counterdie need be used. After removing from the swedger, the platinum base is removed from the metal die and any excess platinum is trimmed away; the base is then returned to the Healey cast and swedged upon it, a piece of rubber dam being used to keep the putty from forcing itself between the base and the cast.

**Iridioplatinum Wire Strengtheners.**—For reinforcing the periphery, 18-gauge iridioplatinum wire is used as follows: The platinum base is imbedded in crown and bridge investment, leaving exposed near the heel and border a surface about one centimeter in length on the palatal side of the crest along one tuberosity; the wire is contoured and tacked just below the outer crest of the ridge; holding the wire with one hand and the blowpipe in the other, the wire may be contoured to follow the border, using or dispensing with pliers (Fig. 230). It is fastened at intervals determined by the abruptness of the contour, and when contoured and tacked along the entire periphery in

this manner, the base may be removed from the investment and the soldering completed. For soldering, Rhotanium, (manufactured by the Rhotanium Co., Cuyahoga Bldg., Cleveland, Ohio) a substitute for platinum, is used. This metal may be used in building up contours

Fig. 230.—Contouring the iridioplatinum wire along the periphery under the heat of the blowpipe.

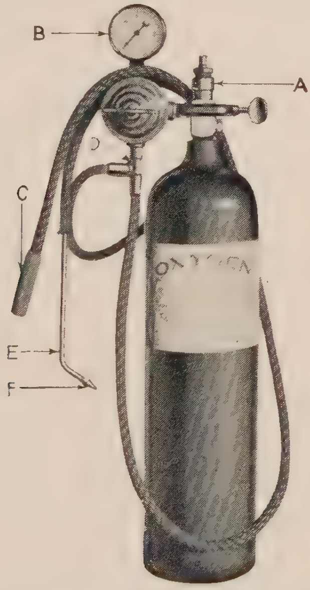



Fig. 231.—For metal work of the continuous gum denture, the No. 1 outfit manufactured by the Kansas City Oxygen Gas Company is used. *A*, valve of cylinder; *B*, pressure reducing regulator and gauge; *C*, connection for illuminating gas; *D*, outlet to torch; *E*, torch; *F*, tip.

and for filling in spaces where an ordinary platinum solder would not stand up in bulk. Rhotanium meets these requirements ("C" grade) and flows under the blowpipe more readily than a 25 per cent platinum solder. It flows at a temperature of 200 or 300 degrees below that

required for pure platinum. The oxygen-illuminating gas flame is used in contouring and soldering. In using this flame, the author employs the No. 1 outfit manufactured by the Kansas City Oxygen Gas Co., Kansas City, Mo. (Fig. 231.)

**Base Is Swedged upon the Healey Cast.**—Any excess solder which might prevent the base from seating upon the Healey cast is removed, the base is returned to the Healey cast, and again swedged in the putty swedger. After swedging this time, and before removing the base from the cast, the posterior border is strengthened. In the strengthening process, a line is drawn across the platinum to mark the desired length of the base, and along this line upon the palatal surface extending over the crests of the ridges, a surface of compound is built

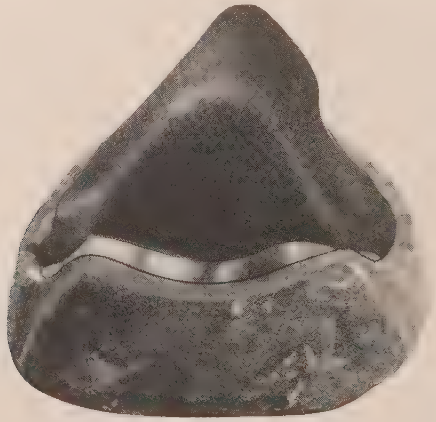


Fig. 232.—A mass of black tray compound assists the operator in turning the posterior border of the platinum base to serve as a doubler.

up at right angles to the base. This gives a clear-cut edge at right angles to, and against which, the base may be turned along the posterior border (Fig. 232). While the operator holds the base firmly in place with one hand, the other is employed to insert a knife under the edge of the platinum and to force it against this surface. If this is done with care, the platinum will not be slit or broken. When the compound has been removed, a ball burnisher is used to burnish down the raised portion, thus giving a double thickness of platinum along the posterior palatal border. The base is now taken from the cast and the turned edge soldered with Rhotanium to make it as nearly as possible an integral part of the base. This doubler may be left as wide as the operator's judgment may approve, but the author has found that three millimeters is sufficient. The end of the wire which

was contoured along the periphery is connected with the doubler in such a way as to form a continuous line with it. When this strengthener has been finished, the case is returned to the Healey cast and the wax-occlusion rim adapted. After securing the occlusion the teeth are arranged in the same manner as for any other case; with the teeth in position, the case is returned to the Healey cast, along the border of which—in the region of the second molar, the second bicuspid and also between the lateral and cuspid on each side—notches are cut to assure correct and compact reassembling of the matrices which are now poured of plaster. These notches may be seen in Fig. 233.

**Teeth May Be Set on Platinum Base or Set on Base Plate and Then Transferred.**—If the operator must order his pure platinum from a distance, he may send his tinfoil pattern with his order and, while waiting, construct upon the Healey cast, his occlusion model with the use of base plate material. He then may "establish central occlusion," mount the casts upon the articulator, set up the teeth, and prove them in the mouth. From this point the procedure is the same whether the temporary base is used or the platinum base itself is employed. In the case of the former, of course, a transfer to the platinum must be made at a later stage. We shall presently call attention to this.

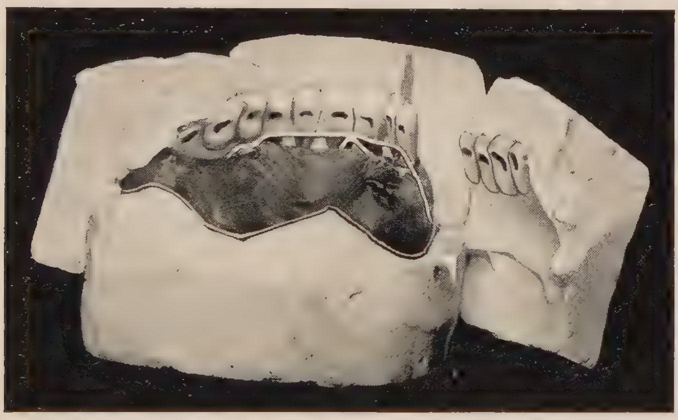


Fig. 233.—One of the plaster sections removed, showing teeth in their matrices.

In either case the base is sealed to the cast, care being taken to keep excess wax from the border of the cast, while any excess wax around the gingiva of the teeth also is removed. The matrices of plaster are poured over the occlusal and buccal surfaces of the teeth

extending to the bottom of the cast; for purposes of convenience these are poured in three sections; the six anteriors in one section, with the posteriors forming the other two. When poured, these plaster sections are removed (Fig. 233), and the teeth thoroughly cleansed of wax by boiling in water; the wax is cleaned from the platinum base by burning off in the flame.

**Iridioplatinum Pins Are Substituted.**—The base is returned to the Healey cast and the teeth put in their impressions in the sections. Each section is placed in position on the cast and the space between the base of each tooth and the platinum base is noted; where necessary, each tooth is ground sufficiently to permit the insertion in the diatorics of 16-gauge iridioplatinum wire long enough to be attached to the crest of the ridge, while leaving the tooth in its proper occlu-

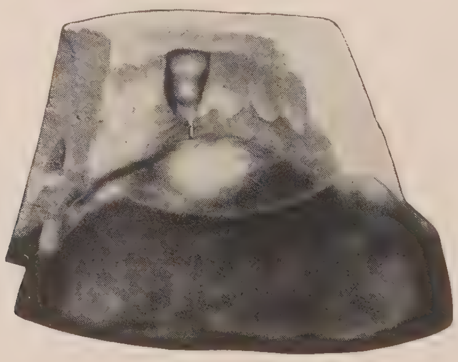


Fig. 234.—Tooth supplied with No. 16-gauge iridioplatinum wire.

sion (Fig. 234). In the case of alloyed pin teeth, the pins are cut off flush with the porcelain, and a No. 234 mounted carborundum stone is used to grind out the stumps in such a way as to leave a concave surface in the ridge-lap and shut portion of the tooth (Fig. 235).

**Porcelain Is Baked Around the Pin of Each Tooth.**—With the teeth reassembled in the matrices and with wires of proper length in position and attached with a drop of wax to the base, Allen's Body Porcelain is packed around the wire and in the hole of each tooth, while the tooth is lengthened and built up around the iridioplatinum pin with porcelain until it extends almost to the base, leaving just enough of the pin exposed for soldering. With hot blasts from a chip-blower, the wax around each tooth is removed from the matrix, the excess porcelain removed from it, and the tooth then placed upon a fire-clay tray, put into the furnace and fused by any one of the various methods

employed to bring the temperature up to 2100° Fahrenheit. The writer has used a Pelton & Crane (Detroit, Mich.) furnace for over ten years. Their No. 2 "Pelton" Perfect Porcelain Outfit is complete with furnace and pyrometer arranged on a compact table which protects the pyrometer from heat radiation from the furnace (Fig. 236).

**Trubyte Crowns Are Preferred.**—Since it is now possible to obtain crowns in Trubyte moulds, the author prefers, in cases permitting the use of long teeth, to use crowns, since they make possible a more natural lingual contour. Their use also makes unnecessary the preparation required when the operator must adapt teeth already supplied with pins and substitute in their stead the iridioplatinum wire. The mould numbers on the lingual surfaces are removed by grinding and the holes for the pins are etched with hydrofluoric acid.

Fig. 235.—Showing tooth in successive stages of substituting the iridioplatinum wire for attaching to the base; together with stone used.

**Reinforcing Wires in Sufficient Number Are Important.**—After the pins are baked into the teeth, these are reassembled in their matrices upon the cast, and places marked for the location of 16-gauge iridioplatinum reinforcing wires. It is difficult to overemphasize the importance of supplying these wire trusses in sufficient numbers, since the strength of the finished denture lies almost wholly in the strength of this substructure. These wires should be placed as follows: One near each heel, one between the first and second molars, and one between the first and second bicuspids, all of these extending over the crest of the ridge and coming in contact with the buccal border of the base. A stronger result is secured if these wires are not permitted to lie in contact throughout their length; it is better to employ points

of contact at the ends and upon the crest of the ridge, in which case they serve as suspension braces, as shown in Fig. 237. However, this is not possible in the case of the three or four palatal strengtheners

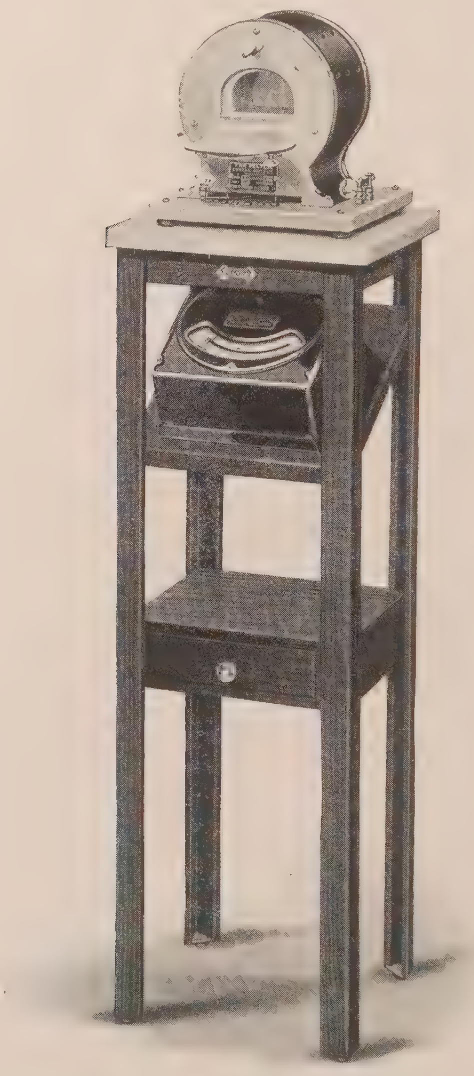


Fig. 236.—The No. 2 "Pelton" Perfect Porcelain Outfit is compactly arranged.

which lie across the median line. These will be in contact with the base throughout their entire length. Previously, these are flattened so that an unusual bulk of procelain will not be required to conceal

them. Finally, one is contoured to the border of the base following the contour and over the labial frenum, extending twelve or thirteen millimeters on either side. When esthetic demands require that the incisal or occlusal edges of the teeth shall be very far from the platinum base a special truss of iridioplatinum wire is employed to support the teeth. Fig. 238 shows a suspension truss of this kind.

**Labial Frenum Should Not Weaken the Denture.**—If the labial frenum is very pronounced, dipping down and attaching in the median line upon the crest of the ridge, it is easily seen that such an opening in the median line of the finished denture will tend to weaken it.

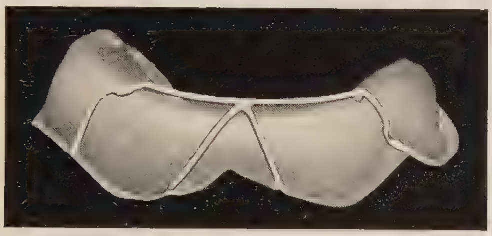


Fig. 237.—Platinum base with strengtheners and suspension braces.

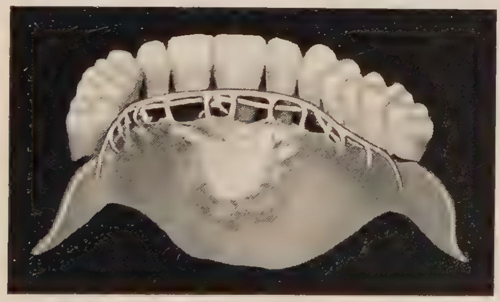


Fig. 238.—When esthetic demands require that the incisal or occlusal edges of the teeth shall be very far from the platinum base, a special truss of iridioplatinum wire is employed.

Accordingly, the original Healey cast is trimmed here so that upon it the case appears to have a frenum attached high above the crest. When the denture is ready to place in the mouth, a local anesthetic is employed, and the patient's frenum clipped back freely. The denture may then be inserted and worn while the tissue is healing. In the majority of cases no unusual discomfort is experienced by the patient. If the denture is not worn continuously during the healing period, the tissue soon will be restored in such manner as to defeat the purpose of the operation. (See Figs. 148 and 149.)

**The Base Is Invested Preparatory to Soldering.**—The case is now reassembled on the cast and the teeth stuck to the base, using pink wax for this purpose. The matrices are then removed and the base carrying the teeth is taken from the cast and invested for soldering. The base is filled with the investment and the teeth entirely covered, leaving exposed the palatal surface and the wax which holds the teeth. After the investment has set, the wax may be removed with boiling water, which will leave the pins and the palatal portion of each tooth exposed. This exposed portion is covered with thin investment applied with a camel's-hair brush. When this has set, the investment around the juncture of the pin with the platinum base is washed out. Squares of 32-gauge Rhotanium, about two millimeters square are forced between the iridioplatinum pins and the

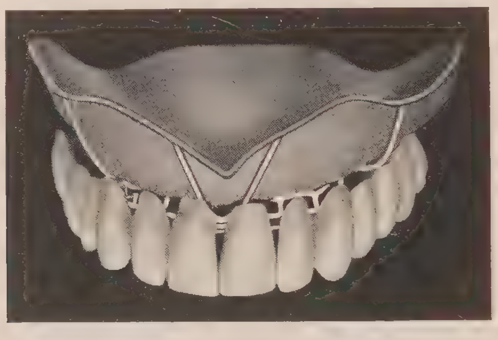


Fig. 239.—Teeth soldered to the base and to the truss wire.

base. The whole case is put over the flame and heated to a cherry red when, with the oxygen-illuminating gas blowpipe, the pins are soldered to the base. Fig. 239 shows the teeth fastened in place; they have been soldered to the base and also to the truss wire. No flux is required since we are engaged with noble metals and employing a nonoxidizing as well as noncarbonizing flame. The case is set aside until cool enough to be handled. In the mandibular base, before assembling the teeth preparatory to soldering, a length of 16-gauge iridioplatinum wire is soldered from heel to heel slightly below the crest (Fig. 240). This is done as a precaution to prevent warping, and the wire is allowed to remain in position until the denture is finished.

**All Foreign Material Should Be Scrupulously Removed.**—In removing the investment after soldering, it will be found that some of the investment has been fused with the porcelain near the pins. With

a sharp instrument, and with small mounted stones every trace of the investment is removed, since it is absolutely essential that all foreign material be removed from the teeth and the base in order to avoid gas bubbles which are likely to be caused through its presence. Gas bubbles prevent the porcelain body from fusing as a solid mass. Whenever possible, small pieces of baked porcelain are gently inserted between the ridge-lap of each tooth and the platinum base, in order to prevent any subsequent movement of the teeth.

**Applying Body Porcelain.**—The base is now ready to receive the porcelain. Fig. 241 shows a base at this stage. Trubyte crowns instead of teeth have been used. Allen's "Continuous Gum Body Porcelain" is used in conjunction with Close's "Gum Enamel Porcelain." The body porcelain is mixed with distilled water to a thick,

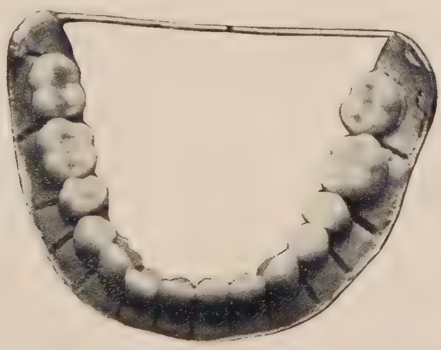


Fig. 240.—Base showing shrinkage after the first bake; also iridioplatinum wire soldered from heel to heel to prevent warping.

creamy consistency and with a spatula applied to the base and around the teeth, while during the process the base is "fiddled" with the same instrument in order to pack it. The porcelain is built up to the full contour desired, no cognizance being taken of possible shrinkage. When built up, the porcelain is trimmed around the gingiva and the labial border of the teeth. With a piece of matrix band steel which is cut in triangular shape with sides about three centimeters in length, the body porcelain between the teeth is cut through to the platinum base (see Fig. 240). This is generally done in the maxillary base by cutting between the two centrals and extending this cut the entire length of the base; succeeding cuts then will form transversals uniting with it. The buccal and labial surfaces are cut similarly. In cases of extreme distance between the ridges, since there will be a considerable distance between the base and the teeth, it is advisable to make an

additional cut about three millimeters below the base of the teeth, and running parallel with the ridge (Fig. 242). This method of cutting helps to determine the course of shrinkage around each individual tooth, and it is rare that the porcelain in shrinkage along these lines will draw the teeth out of alignment. After cutting in the fashion described, the porcelain will be packed along the sides of the cuts, leaving little ridges which would result in tiny spines standing after the fusing process has taken place. In order to avoid this, spatula and brush are employed to pack these ridges down and brush them out until the cuts are practically obliterated. When this is done, the edges of the cuts fuse down and leave a concave depression, and a more nearly smooth surface instead of sharp cuts.

**First Bake Results in a Comparatively High Glaze.**—The base is now placed upon a fire-clay slab, both heels, the anterior portion of the periphery and, when possible, the posterior border of the palate touching this tray. It is placed in the furnace and gradually brought up to 2100° Fahrenheit; this constitutes the first bake and during it a fairly high glaze should be secured. When the first baking is done in this manner, the operator knows that he has obtained a good foundation which will not be changing during the successive processes. The author finds 2100° sufficient with the Pelton and Crane furnace; each operator must test his own furnace. A piece of pure gold placed upon the tray will melt near the temperature at which the current should be cut off.

**Body Porcelain Is Applied and Successively Baked Until Surface Is Free from Cracks.**—If the case is removed from the furnace immediately and placed under a cover glass, it will cool in much less time than will be required if allowed to remain in the furnace while cooling. When cooled enough to permit handling, it is forced into place upon the cast, and if warped it may be necessary to break away the porcelain sufficiently to permit the close adaptation desired. When removed from the cast, the grooves are packed with porcelain and the contours built up whenever necessary; it is then replaced upon the slab and baked in the same manner as at first; when finished, it is cooled as before. Remaining cracks may be filled again with body porcelain and the pink gum porcelain applied before baking again, but the author prefers to fill these minor checks and rebake as many times as necessary until the body porcelain presents a surface free from cracks (Fig. 243).

**Pink Enamel Coat Is Scraped Thin at Points for Shading.**—When the base has been supplied with body porcelain as desired, the gum enamel porcelain is mixed with distilled water and a coating about a millimeter in thickness is applied, extending down below the gingiva of the teeth. This coat is scraped down thin at some points in order to give the desired shadings of color. A drop of water is now placed upon the pink porcelain at the gingiva of each tooth, and with a short, flat camel's-hair brush pressed against the tooth, the pink porcelain overlying the cervical margins may be pushed back in a roll, thus producing a contoured gingival border. The denture is now placed in the furnace and again baked at a temperature of 2100° Fahrenheit. Just before this point is reached, it is advisable to look into the furnace to see whether the case is properly glazed. It is properly fused when the surface of the porcelain presents an oily appearance. This time it should be allowed to remain in the furnace until cold, in order to allow it to temper properly and consequently give it the desired strength.

**Garnet Discs for Finishing the Porcelain.**—In removing the thin layer of porcelain that may have overlapped the border, garnet discs are used, and the platinum is then given a high polish. Figs. 244, 245, 246 show two maxillary and mandibular full dentures after final baking.

**Boiling Denture in Stearine Renders It Sanitary.**—The denture is now placed in a pan of hot stearine and boiled until bubbles no longer rise. It is then removed and the stearine wiped from the surface. This boiling is necessary because of the fact that the porcelain is porous and because there is no absolute union between the platinum and porcelain; the stearine fills up the pores and spaces, and since its boiling point is sufficiently high, nothing that is taken into the mouth will melt it. The use of stearine renders the denture impervious to moisture thus making it highly sanitary; this is, so far as the author is aware, a new method.

**Repairing a Fractured Tooth.**—When a case is received to be repaired, it is placed in the furnace and *very* slowly raised to a temperature which melts out the stearine, drives off all moisture, and burns out any products of fermentation that may have collected since the fracture. After the case has been burned out thoroughly, the repair of the continuous gum denture is a very simple operation, if it is concerned with one or two teeth which have been broken off with a clean fracture. The broken pieces are placed in position with the

aid of liquid silex. After the silex dries and the denture is put into the furnace, it may be fused gradually at a temperature at least one hundred degrees below the original fusing point.

**Repairing Fracture of Porcelain.**—When a fracture of the porcelain itself occurs without disturbing the teeth, a different method is employed. A jeweler's small hammer is used to tap the line of fracture gently until it is enlarged sufficiently to permit the packing of new body porcelain. The same procedure in baking is followed as that which we have indicated in original construction.

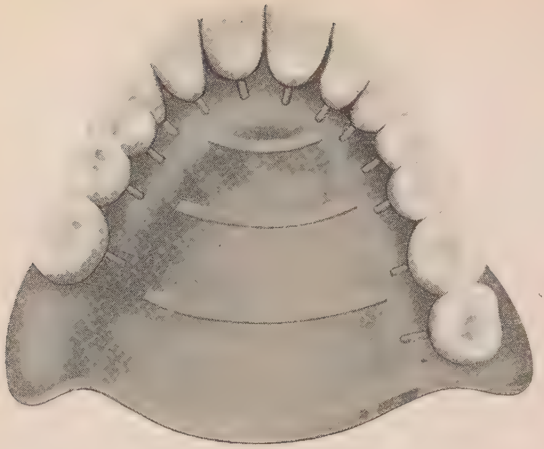


Fig. 241.—Platinum base ready to receive the body porcelain.

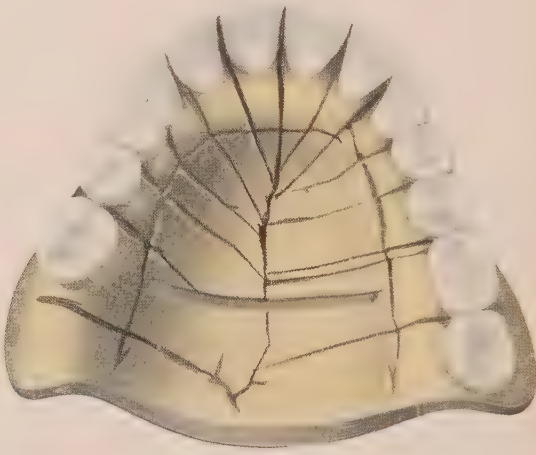


Fig. 242.—Case showing shrinkage of body porcelain after the first bake.

Fig. 243.—Ready for the pink gum enamel.

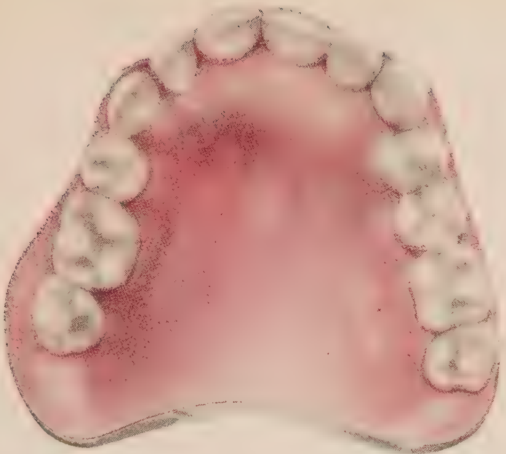


Fig. 244.

Fig. 246.

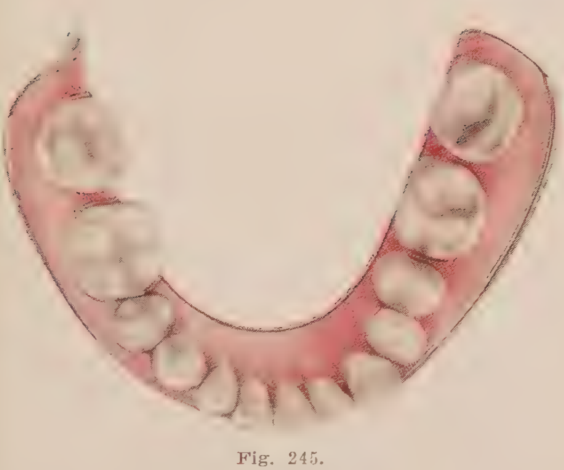


Fig. 245.

These figures show two full upper and lower dentures after final baking.

## CHAPTER XV

## CORRECTING NUMEROUS DIFFICULTIES

Prosthetic dentistry, like any other phase of dentistry, or any other department of activity in life, has its problems and difficult angles; some of these, of course, are imaginary, while others present tangible physical irregularities which need to be corrected. In some professions and industries it is possible to ignore the imaginary difficulties, but the prosthetist sometimes finds that a patient with difficulties of the imagination needs more attention than a patient who is wearing poorly adapted dentures. Both types of patients have their difficulties and the correction of these difficulties is an important part of prosthetic practice.

### I. Often a Denture Which Seems to Be Properly Constructed Lacks Sufficient Retention

(1) When the patient opens his mouth wide the denture drops.

Cause: This may be due to the fact that the labial portion of the denture is too high. In order to improve the esthetic appearance of the face, the labial portion has been built to round out the lip in the region of the cuspid eminence, or the palate may be too short.

(2) The denture drops when the patient's jaws are at rest but the teeth are not in occlusion.

Cause: This may also be due to building out the labial portion to improve the esthetic result.

(3) The denture drops when the patient bites his teeth together while not engaged in mastication.

Cause: This is probably due to faulty occlusion of the anterior teeth.

(4) The denture is easily displaced without any apparent reason, but the displacement usually occurs in the late afternoon or evening.

Cause: Fatigue results in temporary loss of tonus in the tissues and a consequent loss of adaptation of the denture.

(5) The denture is easily dislodged when the patient engages in some specified use of the lips or oral cavity, as in blowing the sawdust from around a scroll saw, or in eating an apple.

Cause: The action of the muscles or tissues in this type of action is opposed to the action required for retention.

(6) The denture is displaced during mastication because of patient's tendency to chew with his anterior teeth.

Cause: The patient may have been without his natural posterior teeth for several years before he lost the anteriors and has formed the habit of chewing with his anterior teeth, which habit he maintains after the artificial dentures are inserted.

**II. Correction of Difficulties Suggested in I**

In all cases in which patients have difficulty in satisfactorily retaining dentures, the operator should first note whether the denture is sufficiently post-dammed.

To test sufficiency of post-damming: When the patient has previously informed the dentist that the denture drops too easily, the patient is received and seated in the chair, and then, before the patient has had time or opportunity to demonstrate how expert he has become in dislodging the upper denture, the operator should insert his index finger into the patient's mouth just under the two centrals. Then, with the finger crooked, he should exert considerable force at this point in attempting to pull the denture forward, allowing the finger to slip off of the teeth and out of the mouth. The operator may do this quickly as a violinist uses his finger in snapping the string of his violin for pizzicato effect, one or two times and then say: "Well, you seem to have a good retention all right. I don't see that you need my services." If the denture is retained in spite of these attacks, the patient will be encouraged by this demonstration in the belief that the retention is better than he had come to believe. Thereafter, he will be more agreeable to the operator's suggestion that perhaps too much has been expected of the dentures in the matter of retention and that he may well recognize the fact that dentures have their legitimate limitations. Some patients will thus easily be helped to see that while restrictions in the use of artificial dentures are different from those imposed upon the use of natural teeth, these restrictions are as valid as those in the case of natural teeth which forbid their use as a nut-cracker or as a pair of pliers.

If the operator is successful in dislodging the denture, he may well be assured that the posterior palatal border is not sealed against the ingress of air. (In preparation for this test as described above, it might be advisable for the operator to practice some time with a patient who has dentures which he knows cannot be thus dislodged.)

Correcting insufficiency of post-damming: The posterior palatal border must be raised until this border has a tendency to imbed itself in the soft tissue immediately adjacent and distal to the hard portion of the palate. With Kerr's stick compound, a layer is penciled three to eight millimeters wide along the posterior palatal border of the denture from tuberosity to tuberosity. The layer should be narrowed slightly and its thickness reduced to a minimum, as it approaches the tuberosities—none of the compound should be permitted to encroach upon either of these. After the compound is applied, it is chilled in cold water, wiped dry and then the surface superheated, dipped in hot water, placed in the mouth, and pressed up into position and held firmly until cool enough to remove without distortion. If the base is of vulcanite, the portion to which the Kerr's compound is applied should previously have been scraped lightly in order to afford a surface to which the compound will adhere. When removed from the mouth, any excess is cut away and the operation repeated until the area is post-dammed to meet the requirements of the case.

The results of this addition of compound should be evident immediately, but the proof as to whether this addition has solved this particular problem of retention will best be left to the patient. He may be permitted to wear the denture for a few days in order to determine whether this correction has solved the problem. When it is demonstrated that the problem of retention has been solved by this addition of compound, the operator will proceed then to adapt the base so that it will follow the new line of adaptation indicated by the compound.

The following technic is employed in adapting the vulcanite base along the posterior border: Any undercuts in the base are filled with just enough plaster so that the cast when poured may readily be removed. A cast is poured of plaster (Fig. 247). It should be poured as thick at least as the width of the denture. When it is hard, the denture is removed and the modeling compound broken and scraped away, after which the denture is returned to the cast.

The denture upon the cast is passed over the flame and very gradually heated along the extreme twenty millimeters of the palatal border from tuberosity to tuberosity. Since the vulcanite is not a good conductor of heat, the operator must give ample time for the heat to penetrate. When the vulcanite is finally so hot that it is almost ready to burn, the cast is laid upon the bench and the operator lays a towel or a bulk of asbestos upon the vulcanite base to keep

from burning his thumbs while they are employed to press the now pliable base down upon the cast. While it is held in close contact with the cast, an assistant pours water upon it until it is thoroughly chilled. Precaution should be taken to apply the pressure with the thumbs in such manner as to hold at the same time the ridge portion of the denture in contact with the cast (Fig. 248).

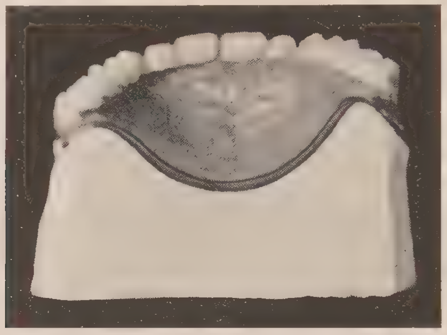


Fig. 247.—In correcting insufficiency of post-damming, Kerr's stick compound is added and a thick cast is poured of plaster.

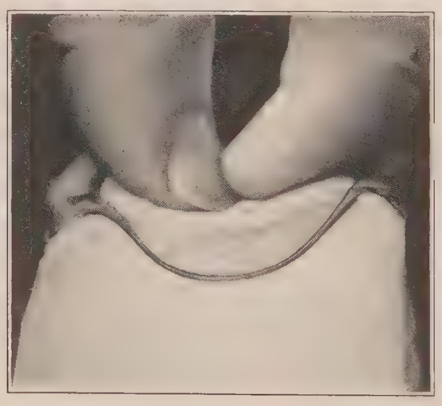


Fig. 248.—Pressing the palatal border of a vulcanite denture hot against the cast in order to correct insufficient post-damming.

If close adaptation is not secured through the first operation, it may be repeated.

If the denture is of aluminum or gold, the technic differs only in the method of pouring the cast with Austin's Synthetic Stone, Healey's, or some other of the hard cast materials, and in the method of adaptation. The intaglio of the denture as supplied with the Kerr's compound is filled with the cast material and the lower part of a

flask used for vulcanite cases is filled with some of the same mixture. The denture is inverted and settled down into the flask and the case is trimmed up neatly. When the cast has hardened, the denture is removed and the compound, which has been used in correcting the border, is then broken off. The denture is returned to the cast and a mixture of plaster is poured over the buccal and labial surfaces of the denture including the teeth. This is to prevent the buccal portions of the denture from drawing away from the cast during the process of swedging. In adapting, a hard wood stick, such as a vulcanite scraper handle, is used to burnish the metal down against the cast. In burnishing, the operator begins at the tuberosity on each side and burnishes toward the median line, burnishing lightly at first and gradually increasing the pressure until the base is closely enough adapted to permit the use of light blows of a hammer against the burnishing stick without splitting the gold or aluminum. When thoroughly adapted, it is removed from the cast and polished.

Correction in the case of (1) and (2) is made by using the sandpaper chuck with sandpaper or a sandpaper wheel to cut down the labial bulk until the weight of the lip no longer tends to pull the denture down. This may be done gradually and during successive visits of the patient to the office in order to avoid sacrificing any more of the esthetic effect than is absolutely necessary to improve the retention. Of course, each time the vulcanite is cut away, the denture is polished again.

(3) If the occlusion of the anterior teeth is imperfect, this may be corrected with the use of carbon paper to detect the irregular points, and by cutting away a sufficient portion of the incisal surfaces of the anterior teeth to prevent contact.

(4) Loss of retention through fatigue is only temporary and will be improved after the patient has had sufficient rest. A recurring experience of this kind extending over a long period often may be remedied with new dentures which are constructed from impressions taken in the afternoon at approximately the time when the old dentures generally become loose.

(5) If the patient has a habit of using his lips or cheeks in such manner as to dislodge the denture, he should be instructed in another way of using them. For example, he may be accustomed to remove his maxillary denture by distending his cheeks in blowing; at other times, without being aware of it, he may thus distend his cheeks and release the denture. All patients should learn to remove

the denture by placing the index finger over the buccal border of the denture on the opposite side (e.g., using the left finger on the right side) and using the malar process as a fulcrum, and pressing the denture down, which at the same time raises the cheek and permits the ingress of air.

### III. The Patient Complains of Biting His Cheek

Correction: Explain to the patient that persons with their natural teeth frequently experience similar discomfort; after a few days he will probably discontinue this annoying practice.

### IV. The Patient Experiences Nausea While Wearing the Maxillary Denture

Correction: The patient usually attributes this to the length of the base. Before the patient has time to indulge in gagging after the denture is removed, the operator may place his finger in the mouth along the posterior border of the hard palate and press against the vault or rub firmly once or twice and remark: "You see, that doesn't produce nausea; your denture is not long enough." Post-damming may be tried. If the base is too long, it may be shortened a trifle each time the patient comes to the office; it may be helpful to advise the patient that if necessary the base may be shortened a great deal, but that if the length can be tolerated the retention is increased by the greater length.

### V. White Spots Appear on the Patient's Gums

(1) When the cast has been bruised, the base at this point will be too thick. (This is less likely to be the cause of these spots than the other causes mentioned.) Correction: The exact spot on the base of the denture, which is responsible for the irritation causing the white spot on the tissues, may be located with the use of a blunt indelible pencil. Mark the spot on the tissues with the indelible pencil and then after drying the denture insert and press to place—the pencil mark on the tissue will appear upon the base of the denture. This spot should be cut away and relief will ensue. Another method of marking is to use a piece of gummed label or Christmas stamp. Moisten the sticky side and with an instrument lay the other side down upon the white spot on the tissues; insert the denture, when the piece of paper will adhere to the denture and thus definitely mark the spot that must be trimmed away.

(2) White spots may appear upon the tissues because of irritation

resulting from malocclusion. Some one cusp of a tooth of the denture may be too long. This may be determined by putting the black wax upon the mandibular denture and securing central occlusion. (See page 144ff.) The offending portion may be on the inner left mandibular flange just below and between the first molar and the second bicuspid, while the cause of it may be found to be in the mandibular right cuspid. The anterior portion of the labial aspect of the mandibular ridge may be abused by teeth, some one or all of the six anterior teeth being too long either in central occlusion or in lateral excursions. This condition may often be detected with the use of carbon paper and corrected with a small mounted stone in a handpiece.

(3) If attention to probable causes of irritation, as just suggested, fails to give desired results, the cause is probably deeper in its origin. the gum tissue must be opened and spicula or infected process re- The operator should then recommend that radiographs be secured of the region underlying the white spot, or spots; he may thus find that moved. See also Section VI in this chapter where the use of velum rubber is discussed.

(4) If irritation of the tissues is caused by the posterior palatal portion of the denture and it is not wise to sacrifice any of the length of the base, this portion may be burnished to relieve the irritation. If it is a vulcanite denture, the extreme distal portion of the base is gradually but thoroughly heated over a flame; a rounded point instrument may then be used to burnish the offending border downward away from the tissues. If the base is of aluminum or gold, a curved beak contouring plier often may be used effectively. If the entire border of a metal base is productive of irritation, a layer of wax is melted upon the surface of the base—the surface next to the tongue. This layer should be two or three millimeters in width and in thickness it should be equal to the distance it is desired to lower the border in burnishing. A mixture of plaster is poured over the palatal portion of the base and upon the teeth and the case is inverted upon the bench; when the plaster is hard, the wax is melted out, or into the plaster, and the metal base is burnished or swedged down to the plaster with the use of a small hammer and a hardwood stick. The border is then smoothed and polished.

### VI. Case for Which Velum Rubber Base Is Supplied

Occasionally a patient will be found, whose mandibular denture is constantly a source of discomfort. Infected process or spicules which

might be removed by a minor operation are nevertheless tolerated, and the patient refuses an operation as a method of remedying the condition. The use of velum rubber will afford considerable relief from such discomfort, but the patient should be advised that the resultant denture is short-lived and that even with scrupulous care will become unsanitary.

Assuming that the adaptation of the hard vulcanite denture, which the patient is wearing, is correct—or would be correct, if the tissues were normal—a cast is prepared of Austin's Synthetic Stone and trimmed neatly before it has thoroughly hardened. If necessary, a new impression is taken as described in Chapter XVI. After the cast is hardened, the denture is removed from it before proceeding fur-

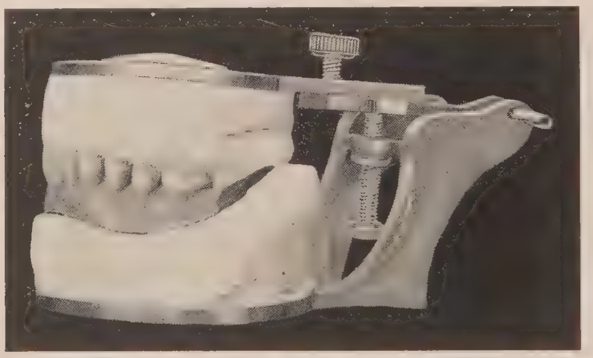


Fig. 249.—The mandibular denture is luted to the articulator so that the upper bow will be included in the plaster matrix which is poured about the occlusal and incisal surfaces of the teeth.

ther; it is then returned to the cast. (This facilitates subsequent removal.) The cast bearing the denture is luted to the lower bow of a plain line articulator. The upper bow is raised above the cast far enough, so that, when a plaster matrix is poured about the occlusal and incisal surfaces of the teeth, the upper portion of the plaster matrix will have incorporated the upper bow (Fig. 249). The upper bow is maintained in this exact position by means of the lock nut. This nut is tightened securely in order that it may remain tightened as long as the articulator is used for this case. Since the velum rubber must be replaced at intervals of six to twelve months, the preservation upon the articulator of the cast and the plaster impression of the teeth will obviate the necessity of taking a new impression each time. If the space between the lingual flanges of the denture was

filled with wet tissue paper and the teeth covered with a coating of liquid silex before the plaster matrix was poured, the bows of the articulator can be opened easily and the denture removed from the plaster impression.

The base of the denture is cut away so that velum rubber to a depth of five or six millimeters may be substituted. The intaglio remaining is also cut out with the use of sandpaper on the arbor of the lathe and, where necessary, with a heatless stone; this will permit the velum rubber to be supplied as a cushion with a depth of not less than five millimeters over every part of the base which rests upon the tissues.

No. 60 tinfoil is burnished upon the portion of the Austin cast which will be covered by the base, and allowed to extend four or five millimeters beyond it in all dimensions (Fig. 250). The tinfoil must

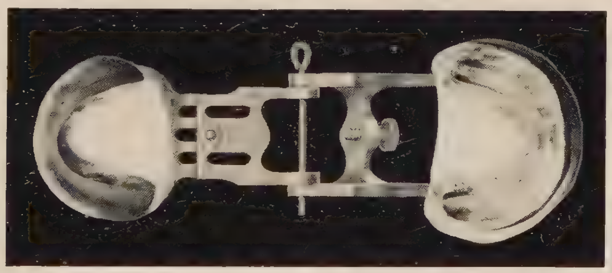


Fig. 250.—The base of the old denture is prepared to receive the velum rubber; the cast is supplied with No. 60 tinfoil which is allowed to overlap 4 or 5 millimeters in every direction.

be burnished down very closely, since any failure here affects the adaptation of the base. A piece of base plate wax should be softened and pressed down upon the tinfoil and the base of the denture (with the teeth setting in the plaster impression of the upper bow) pressed down upon the wax as far as the stop set-screw will permit. The excess of wax is trimmed away evenly and the tinfoil burnished up over the wax remaining so that the tinfoil thus forms a mould within which the velum rubber may finish smoothly, since it cannot be polished the same as ordinary hard vulcanite.

The tinfoil burnished to the height of the wax is then turned out and down at an angle a little less than a right angle in order that it may be imbedded in the plaster when flasked (Fig. 251). It is flasked in the usual manner, in this instance bringing the plaster up just far enough to cover the tinfoil and not encroach upon the vulcanite. The case is opened and packed after the method described in Chapter I,

but using velum rubber. In order to assure a close union between the new velum rubber and the old vulcanite, a coating of rubber is applied just before closing the flask for the last time. This coating of rubber is supplied by wrapping a small piece of ordinary base rubber in cotton and then dipping it in chloroform and rubbing over the old vulcanite until it appears to be well painted with the rubber solution.

The case is vulcanized for the same length of time and at the same temperature required for ordinary vulcanization. When removed from the flask, the tinfoil is removed and any excess of rubber is cut away with sharp scissors which have been dipped in water. Wherever cut, the edge is seared with a red-hot spatula and immediately

Fig. 251.—The tinfoil burnished to the height of the wax is turned out and down in order that it may be imbedded in the plaster when flasked.

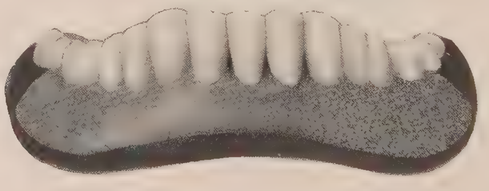


Fig. 252.—The denture finished with velum base.

wiped with a pledget of cotton moistened with chloroform. Only a small portion should be seared before the chloroform is applied, since its effect is more satisfactory while the rubber is still warm.

If the denture is to be placed in the mouth immediately, the sticky surface resulting from the use of chloroform should be dusted with talcum powder. If it is allowed to stand two or three hours before inserting, the talcum powder will not be required. Fig. 252 shows the finished denture.

**VII. Cases Requiring Change of Alignment.**—Fig. 253 shows a case in which the alignment of the natural or restored mandibular teeth is abnormal. In protrusive or lateral movements, the patient cannot

avoid displacing the maxillary denture, as indicated in Fig. 254. Satisfactory solutions of the difficulty provide for removal of the interfering maxillary tooth, its reduction to line indicated, or (if the esthetics of the case permit) a depth of overbite which in end-to-end occlusion will compensate for the angle involved.

In Fig. 255 is presented a full maxillary denture with a partial mandibular denture. In a protrusive movement of the mandible as shown in Fig. 256 (also in lateral movements) occlusal contact is

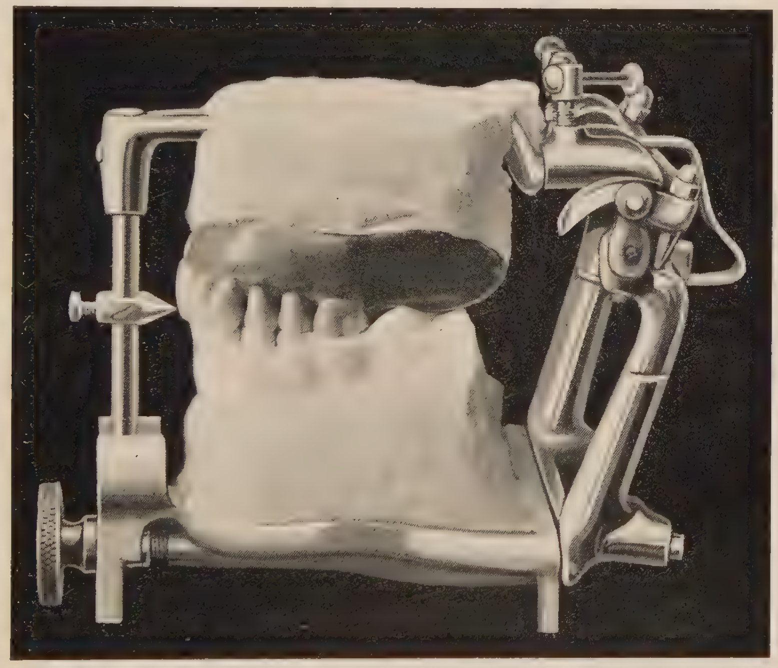


Fig. 253.—A case in which displacement of denture is due to the alignment of the mandibular posterior teeth.

destroyed except in the anterior portion. This results in a displacement of the maxillary denture. In Fig 257 is shown the case as reconstructed to obviate this difficulty. A compensating curve, the depth of which corresponds to the depth of overbite provides the solution. Fig. 258 may be compared with Fig. 256 and the difference in alignment noted.

**VIII. Not Infrequently, Malalignment Results from Vulcanization.**—Not infrequently an operator may find that after he has exercised unusual diligence in securing the correct occlusion, and has main-

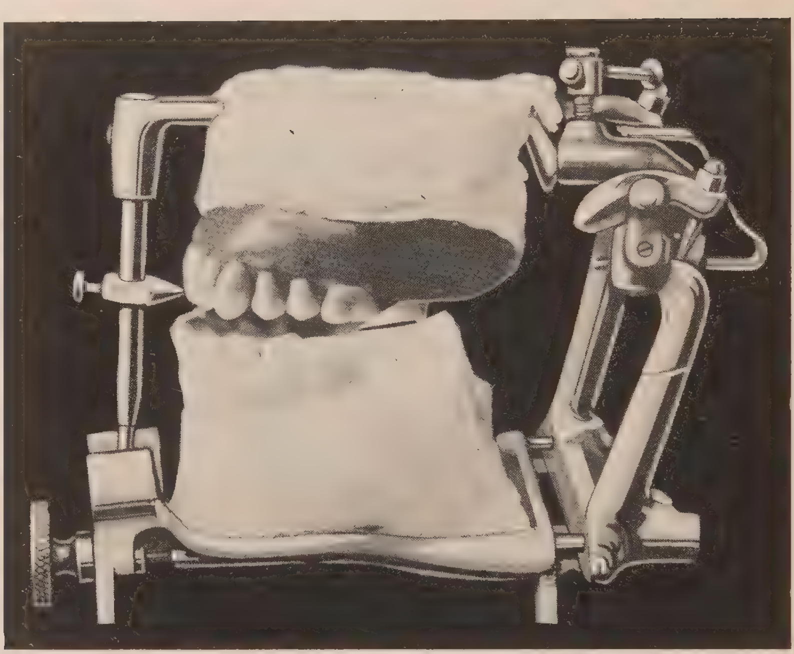


Fig. 254.—The displacement occurs during protrusive or lateral excursions.

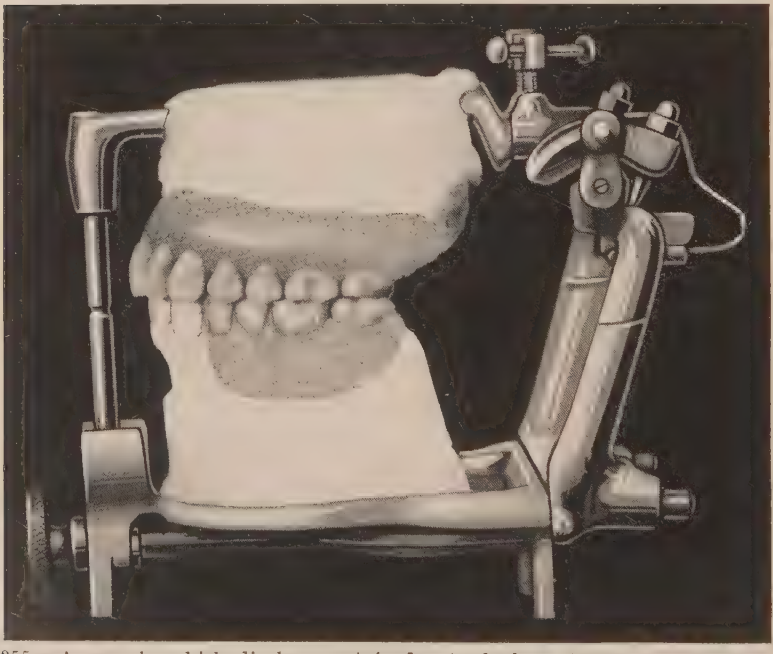


Fig. 255.—A case in which displacement is due to faulty alignment of the teeth of both dentures.

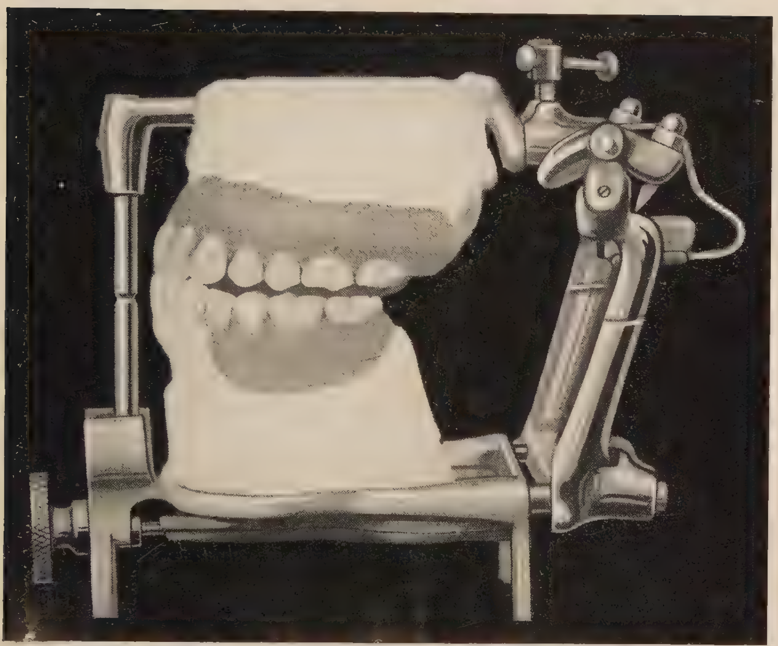


Fig. 256.—In protrusive movements the anterior teeth only remain in contact.

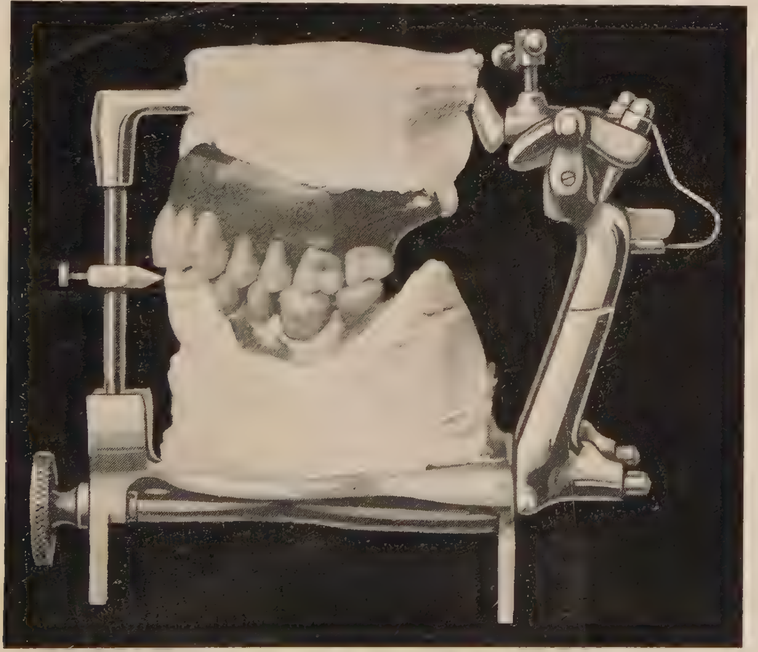


Fig. 257.—The case shown in Fig. 256 after reconstruction.

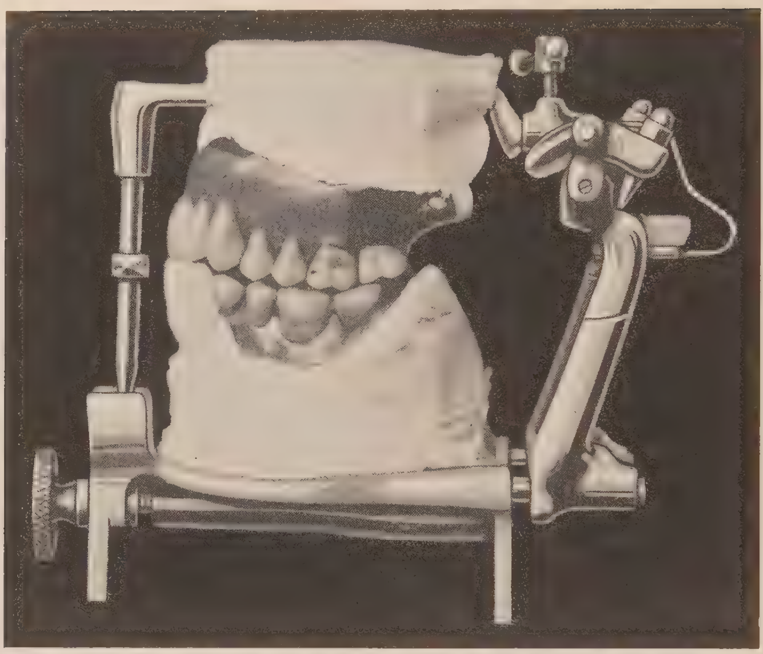


Fig. 258.—The same case shown in protrusive balanced occlusion.

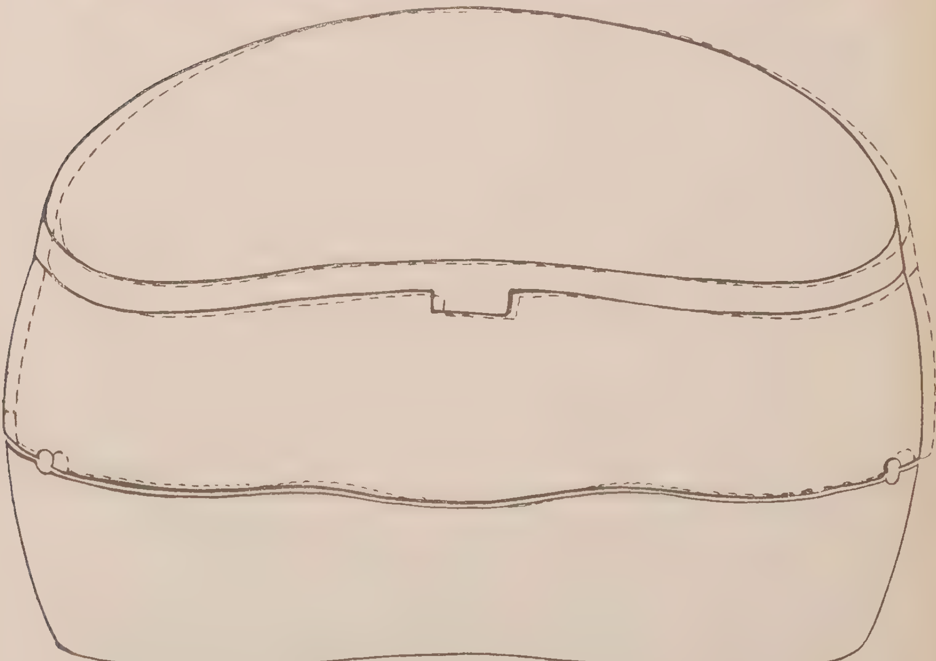


Fig. 259.—Portions of a flask should fit closely together. Dotted lines show possible lateral shifting of one section of the flask in closing which destroys the original alignment of the teeth.

tained this occlusion while the case was mounted on the articulator and during the course of flasking and packing, the denture comes from the vulcanizer with an incorrect alignment of the teeth. When the portions of the flask do not fit closely together, shifting of relationship may easily take place with a consequent disastrous effect upon the original occlusion. Fig. 259 is made from a drawing which depicts the source of this difficulty.

## CHAPTER XVI

## REBASING

**Three Definitions of "Rebasing."**—"Rebasing," according to derivation, means "basing again." However, in dental circles it has been employed to designate the procedure involved in: (1) Replacing the vulcanite in the intaglio of a vulcanite denture—better although incorrectly also called "relining." (2) Replacing all of the vulcanite of a vulcanite denture. (3) Replacing all of a denture, whether vulcanite or metal base, except the teeth.

In this chapter rebasing applies to the usage indicated in (2) although closing paragraphs will be devoted to (3).

**Reasons for Rebasing Dentures.**—Dentures are rebased, instead of replaced with new dentures, usually because the expense of rebasing is less. Since the time required is less, the practice may be fully justified. Dentures are rebased because: (1) as a result of resorption of the tissues, better adaptation is desired; (2) increased retention is sought through increased area—rarely through decreased area; (3) old dentures have been weakened or rendered unsightly through numerous fractures and repairs; (4) gold or aluminum bases are now desired without any change in the teeth or their alignment; (5) the operator wishes to increase or decrease the interval between the maxilla and mandible ("open or close the bite"); (6) the patient wishes a different color of vulcanite.

**All of the Old Vulcanite Is Removed.**—The technic presented in this chapter involves the entire renewal of the vulcanite in a denture. The superior merit of this method is found in the resulting denture; since none of the old vulcanite is retained, the denture will be much stronger than if a portion only of the vulcanite were renewed. Furthermore, the method is short and simple, and the denture when rebased shows no evidence of replacement or repair.

**Old Denture Is Used for Impression Tray.**—The technic is simplified through the use of the old denture in taking the impression for the new base. Central occlusion is more easily registered because the patient more readily tends to close his jaws with a habitual closing movement.

This method follows the same technic in impression-taking as that described in the chapter on Impression-Taking, except that the old denture serves instead of the improvised individual compound impression tray. If the denture which is to be rebased is very thick in its palatal portion, the operator should use sandpaper on the lathe in order to cut it down here as thin as possible. (A tiny hole or two resulting from this thinning operation may be closed with a drop of modeling compound). If this is not done, the rebased denture will be thicker than the original; it will have the added thickness of the depth of plaster used over the palatal portion in taking the impression.

**Compound Is Added as Desired to Change the Contour of Old Base.**—A hole three or four millimeters in diameter is drilled through the vulcanite maxillary denture in the median line just posterior to the central incisors. The base is made perfectly dry and a stick of Kerr's modeling compound is heated in the flame and traced upon the posterior buccal border of the base, extending the tracing from the extreme posterior border to the region of the bicuspids. It is then dipped in cold water momentarily in order to chill the surface slightly so that the operator may mould it with his fingers to the desired general contour of the proposed finished denture. If it is desired to increase the area contact, this contour will be an enlarged "edition" of the old denture. The compound, when thus shaped to a contour which in the judgment of the operator will approximate the desired contour, is chilled, removed from the water and freed of all moisture. A flame is then projected, by means of the chip-blower, against the compound to render it sufficiently impressionable when inserted in the mouth (just as in the case of taking an impression in the regular manner as described in Chapter I).

**Patient Should Close Correctly Each Time.**—After being properly heated and temporarily immersed in hot water to keep from burning the patient, the denture is inserted and the patient instructed to close firmly; any massaging is then done that may be necessary to fashion this additional compound into the desired contour. Since in rebasing, the operator desires to maintain the occlusion as it is in the old dentures, he will see each time when the denture carrying the compound is placed in the mouth, that the patient closes correctly and firmly.

With the patient still closing firmly, the operator lifts the lip and cheek, and with a stream of water chills the compound so that it may be removed without distortion. The opposite border is extended or enlarged in like manner. Then the two remaining labial portions are

in turn supplied with the compound. The posterior border of the denture is traced with the compound in order to lengthen it until it extends back almost to the junction of the hard and soft portions of the palate, because in practically every case in which increased area contact is desired, the palatal portion, more particularly than any other portion of the denture, needs to be increased. A goodly bulk of compound is traced across the distàl portion of the base from the

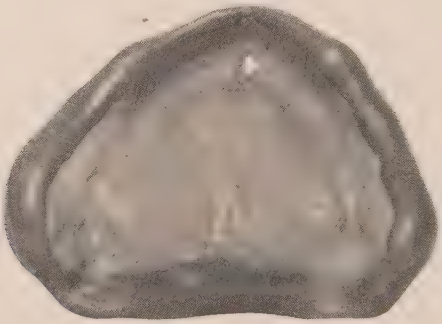


Fig. 260.—Kerr's stick compound added to the border and intaglio side of old denture in preparation for impression-taking.

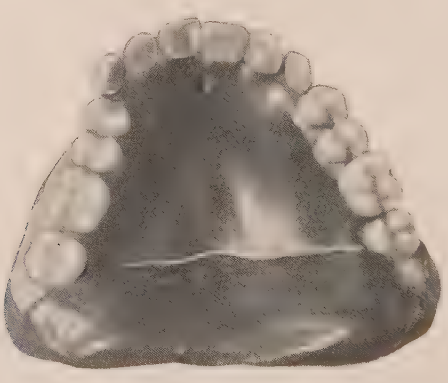


Fig. 261.—The reverse side of posterior palatal portion is supplied with Kerr's stick compound in order to strengthen it.

region of one tuberosity to that of the other and joining with the compound previously added to the posterior buccal border on each side. It is penciled upon both the intaglio and the reverse side of the base in order to furnish sufficient bulk so that the compound will be strong enough to serve the same as the vulcanite while the operator is completing the impression. In supplying the compound, it is penciled along the intaglio side and may be allowed to cover three or four millimeters of the vulcanite on this side. On the reverse side

the compound is penciled while hot and sticky, so that it will be firmly attached and it is extended back over the vulcanite fifteen or twenty millimeters or even farther in order to obtain the strength desired. (Figs. 260 and 261 show compound added on intaglio side, and on the reverse side.)

As the compound cools, it is shaped with thumb and forefingers to conform to the general outline of the palatal portion and in keeping with the approximate form and length which the operator foresees it will finally assume. The black carding wax wire, of approximately 8-gauge, is now supplied along the inner border of the denture as described on page 36 and after it has been inserted and pressed to position, a roll of the wax is employed in post-damming as described on page 37. Since the patient may in this instance close the dentures into proper position the correct occlusion will be maintained as the dentures seat themselves.

**Plaster Escapes Through Hole Provided in Anterior Portion.**—A thin mixture of Kerr's Snow White Plaster (a teaspoonful is usually sufficient, never more than a tablespoonful is required) is placed in the "denture-tray" within the confining borders of the black wax and the denture inserted. The post-dammed portion is placed into position first and then the point against which pressure is exerted is shifted toward the anterior portion. This method of applying the pressure in seating is intended to apply it in such manner as to force the excess plaster forward, in order that it may escape through the hole which has been provided; in escaping through this hole, the plaster does not encroach upon the black wax across the posterior portion and also does not disturb the border seal provided by the black wax.

**Preparing and Pouring the Impression.**—The patient should now close in central occlusion and maintain this position until the plaster is set. The "denture impression" is then removed and washed free of saliva and excess particles of plaster are broken away from the teeth and the vulcanite (Fig. 262). When the impression is dry—usually twenty or twenty-five minutes is sufficient—a coat of shellac is applied and when this is dry a coat of sandarac varnish is applied. After the sandarac is thoroughly dry, the impression is poured with any cast material which gives a cast capable of withstanding the compression incident to closing the flask during the process of packing.

Sufficient cast material is placed in the intaglio of the impression—a small portion each time—and jarred until excess material flows

sluggishly over the border. The impression itself is not directly jarred against the bench, but is held in the hand and the hand jarred against the bench. This method of jarring avoids danger of fracturing any minute portion of the plaster impression.

**Flasking.**—The lower portion of the flask is filled with this cast material and the invested impression is placed in this portion of the flask and gently settled down until no portion of it remains high enough to interfere with placing the top of the flask. It should be "wiggled" into position without jarring, since jarring at this stage may expel the cast material from the intaglio of the denture. After the first or primary setting of the material has taken place—this usually requires about twenty minutes—it is smoothed from the border of the denture to the edge of the flask, by trimming with a knife and by brushing.

Fig. 262.—A completed impression used in rebasing the maxillary denture shown in Fig. 133-*B* of "Immediate Denture Service."

At this stage, if the vulcanite base is to be replaced by a metal base, the technic will vary as described elsewhere.

For rebasing with vulcanite the technic following is employed: With a chip-blower, a yellow flame from the Bunsen burner or the flame of an alcohol lamp is directed very lightly and without haste against the occlusal surfaces of the posterior teeth, and labial surfaces of the anterior teeth, until they are sufficiently hot to warm the surrounding vulcanite. The teeth are thus heated, one at a time, and then with a sharp-pointed instrument are pushed from the vulcanite without difficulty. Each tooth, *while it is hot*, is held with towel or cloth and a sharp-pointed instrument is used to remove the vulcanite from the holes in the diatorics or the pins of the anterior teeth. The vulcanite in the small holes should be pushed into the large hole of a diatoric tooth.

As the vulcanite is removed from a tooth, it is laid upon the bench in regular order with reference to the others of the set. They are *not* laid upon carding wax, since the wax would adhere to them.

**Vulcanite Matrices Are Cut Away to Facilitate Removal of Teeth.**—The vulcanite matrices are cut away with sandpaper on a sandpaper chuck until the old vulcanite base may be removed later from the plaster matrix of the flask easily and without disturbing the original alignment of the teeth. In order to assure this easy removal in the case of molars and bicuspids, all of the vulcanite is cut away except the impression of the base of the tooth, that is, all except the polished seat bearing the imprint of the number and mould of the tooth. (The

Fig. 263.—Flasked denture showing outlines of vulcanite which held diatoric teeth; also showing the remaining teeth—these have been removed, the vulcanite has been cut away, and they have been waxed in position. A central and a lateral have not yet been waxed securely.

upraised central portion of vulcanite which filled the large hole in the base of a diatoric tooth is, of course, cut down until only a bare outline of it remains [Fig. 263].)

**Imprint of Old Teeth Is Preserved.**—The old vulcanite is cut away by the same method, leaving only the imprint of the ridge-lap portion of the six anterior teeth and just enough of the imprint of the pins to assure their proper return to exact former location. The imprint of the pins just referred to is circular, of course; only an arc of this circle need be left in order to mark the definite location of each tooth.

When all of the teeth have been removed, they are then replaced in their respective positions and each one sealed in place with hot wax.

With the teeth all replaced, the case is now waxed up in the regular manner. A thin film of wax is supplied over the vulcanite which was untouched by the sandpaper; a rugapak is placed in position; the exposed portion of the investment is soaped, and the upper portion of the flask is placed upon the lower portion and filled with cast plaster. When the plaster is set, the flask is opened as described elsewhere. The teeth will be held firmly in position in the matrix and the old vulcanite base may be easily removed with the lower part of the flask.

The old vulcanite base is now easily removed from the cast, and the carding wax and plaster which were used in taking the impression are also removed. The case is packed with new rubber, the cast is supplied with a relief and then tinfoiled and the usual procedure followed through the process of vulcanization and finishing as described in Chapter I.

**Packing a Mandibular Denture Which Contains a Large Bulk of Vulcanite.**—For mandibular dentures possessing a minimum amount of vulcanite, a similar technic is employed to that just given for the maxillary denture. When a mandibular denture contains a large bulk of vulcanite, and the operator desires to secure better adaptation than was secured in the case of the old denture, the technic may be varied slightly to good advantage. This variation consists in employing pieces of vulcanite (vulcanite, not rubber) within the body of the new rubber in packing, in order to reduce the shrinkage which takes place in vulcanizing. Where a large bulk of rubber is vulcanized, the shrinkage is often so disastrous that a satisfactory adaptation cannot be obtained without some such method as is suggested here. Dr. Gysi has demonstrated that during the process of vulcanization, rubber contracts or shrinks 14 per cent even under the most favorable conditions. In cases requiring but a small amount of rubber, the amount of shrinkage is correspondingly less and consequently the failure in adaptation is reduced until, so far as practical results are concerned, the failure on this account is practically negligible.

**Incorporating Pieces of Vulcanite During Packing.**—In mandibular dentures which must contain a large amount, the pieces of vulcanite may be incorporated in the following manner. The impression is taken and the progress of the case is similar to that described above for a maxillary denture—up to and including the removal of the old vulcanite. When the old vulcanite has been removed, a facing of

pink rubber is placed in the plaster matrix containing the teeth and then upon this a thin piece of red base rubber is applied. In fact, the case is packed just as a case is regularly packed, except that in applying the first layer of red rubber, it is applied as thin as possible without permitting the pieces of vulcanite, which will be laid upon the thin red layer, to show through both this red layer and the pink facing as well.

**Preparing Pieces of Vulcanite in Order to Assure Close Union with New Rubber.**—An old denture is broken into small pieces, and these pieces of vulcanite are laid against the red rubber at every point where it is possible to place them (Fig. 264) especially at points where on account of the required bulk it is most desirable that

Fig. 264.—To reduce shrinkage and prevent porosity in mandibular dentures of considerable bulk, pieces of *vulcanite* are incorporated in the rubber during the process of packing.

shrinkage should be eliminated as nearly as possible. In order to secure a close union of the pieces of vulcanite with the rubber in vulcanizing, the pieces are prepared by cutting away with sandpaper every particle of polished surface. This may be done to advantage before the old denture is broken into pieces. A brittle old denture is especially advantageous, since it may be more easily broken into pieces of the desired size. In placing these pieces it is just as necessary to open the flask for inspection as in the case of packing entirely with rubber as described in Chapter I.

When the pieces of vulcanite are in place, a final layer of base rubber is applied. The case is then completed just as in other vulcanite cases.

If it is not objectionable to allow the denture's appearance to disclose the fact that it has been repaired, the following method may be employed for a mandibular case. This method requires a minimum amount of time and of new rubber and is accompanied by a minimum shrinkage but, as suggested, the esthetic result approaches the minimum instead of the maximum.

If, in order to get a satisfactory impression, it is not necessary to extend the area of the denture by means of modeling compound, a roll of black wax is sealed around the entire border of the mandibular denture (as described in treatment of individual impression compound tray, page 36). This wax is then warmed slightly and pressed down with the fingers to half the thickness of its original diameter. It is again warmed, and the denture inserted and pressed to position as described in Chapter I.

If it is necessary to extend the area of the denture, Kerr's stick modeling compound is traced around the entire inner border and extended slightly (two or three millimeters) upon the buccal, labial and lingual borders. It is then chilled and the moisture removed, after which the entire surface of the compound is rewarmed. In rewarming the compound, the operator may hold the anterior teeth of the denture between finger and thumb and pass the compound over a small flame from heel to heel, first along the buccal and labial borders and then over the lingual border, repeating several times until all parts of the surface of the compound are equally warmed. It is then dipped momentarily into hot water, inserted in the patient's mouth, and seated upon the ridge. The patient is requested to close, and when he closes to central occlusion, this position is maintained while the operator massages the cheeks and lower lip upward and then chills the compound with a stream of cold water. The case is removed and the lingual portion only is heated again. It is again inserted and held in position with thumb and forefingers while the patient protrudes the tongue to displace any excess which might later interfere with the free movement of the tongue. When thus adequately adapted in the manner previously described, the carding wax wire is employed to equalize the pressure and improve the adaptation.

Whether the Kerr's stick compound has been used to increase the

area before the wax wire is applied, or whether the carding wax wire has been applied directly to the old denture, the technic following this application of carding wax and its adaptation to the tissues of the mouth is the same.

A small quantity of plaster is mixed and is placed within the borders of the black wax and inserted as the operator requests the patient to close. When the operator sees that the teeth are in central occlusion, he requests the patient to hold his tongue firmly against the anterior teeth, while the lips and cheeks are gently massaged upward.

Fig. 265.—If not all of the vulcanite is to be removed, the mandibular denture is inverted when flasked. This gives a line along which the new rubber is added and also facilitates pouring of the cast, which at the same time serves to fill the upper portion of the flask. Note: The vulcanite of the left half has been cut down even with the plaster.

When the plaster is set, the base is removed and any excess of plaster that may have encroached upon the buccal, labial or lingual borders is broken away and any particles adhering are washed away in running water. In breaking away excess plaster from the buccal or labial borders, a sharp or rough edge may often remain. The plaster here may be scraped down even with the vulcanite, or wax may be supplied until the vulcanite and plaster form a continuous line.

Shellac and sandarac varnish are employed as described elsewhere at a similar stage.

The lower portion of the flask is filled with a mixture of plaster of Paris, and the lower denture is inverted (Fig. 265) and the teeth settled down into the soft plaster. Care is taken to bring the plaster up all around the border of the denture to within two or three millimeters of its edge. This line of plaster should be contoured with some regard for its appearance and graceful curvature, since it will determine the line of union of old and new vulcanite and the two shades of vulcanite will stand out in contrast. When the investing plaster is hard, its surface is smoothed and a heavy lather of soap is rubbed into the entire surface of the impression and its investing plaster. The excess of soap is gently washed away with cold water, and the upper portion of the flask is seated in position and poured with Austin's synthetic stone or a similar high grade cast material such as the market affords.

Depending upon the particular material used, the cast will harden sufficiently within a period of from one to twelve hours—Austin's will require an hour, Healey's white artificial stone, the longer period. If placed near heat, all of such materials will harden more quickly.

When the cast material is hard, the case may be opened just as any other preparatory to packing. After it is opened, the plaster and black wax supplied during the impression-taking are removed. With a sandpaper arbor the old vulcanite border of the lower is cut away to a depth of three or four millimeters, or down to the investing plaster. The intaglio, in portions inaccessible to sandpaper on the lathe, is cut out with a heatless stone in the handpiece. If in this process the vulcanite base is kept dry and clean and free of wax, a strip of new rubber may be warmed over a flame and pressed firmly against the sanded surface of the old vulcanite to which it will closely adhere, and, after vulcanization, be firmly united.

If the surface of the sanded (sandpapered) old vulcanite becomes dirty before the operator is ready to pack the case, it may be cleaned with chloroform. Then, the use of a small piece of rubber wrapped within a pledget of cotton and dipped in chloroform and rubbed over the surface of the old vulcanite will deposit a thin film which will make the adaptation of the first layer of new rubber easy and cause it to adhere. This layer is pressed down firmly and other rubber added wherever needed, and the case is closed and opened for inspection as described in the chapter on packing, until a sufficient amount has been added. The upper portion of the flask, which contains the cast, is covered with tinfoil and this is soaped just before the flask is

finally closed. The case is put into a clamp and vulcanized. When vulcanized, it is finished as any other vulcanite case is finished.

When it is desired to replace the old base with a metal base and still retain the original alignment and occlusion, the following method is employed. An impression is taken, using the maxillary denture as an individual tray, as previously described in this chapter, and the case is carried to the stage at which the teeth are to be removed, or the old vulcanite removed from the teeth (see page 330). At this stage matrices, which will enable the operator to return the teeth to their original position and relationship, are now poured of plaster in three sections, in the following manner:

A mixture of plaster is flowed upon labial and occlusal surfaces of bicuspids and molars on one side. The plaster is extended down until it joins with the metal of the flask. The bicuspids and molars of the opposite side are treated in like manner. The plaster at the point between the cuspids and bicuspids on each side is given a sharp square-cut edge and soaped or given a coat of silex so that the next section of plaster, which will occupy the space of the remaining six teeth, may be easily removed from it.

When the plaster is hard, the matrices are removed, the vulcanite of the old base is removed, and a metal base is cast and swedged to adaptation upon the cast from which the old vulcanite denture was removed. In order that the metal base may be swedged upon the cast, the operator should take the precaution to select a flask that may be put into the swedger. The teeth are removed from the old vulcanite base and placed in their respective niches in the matrices and sealed with a small portion of hot wax. Each one of the three sections of matrices is thus supplied with teeth, and finally all three are assembled about the metal base. Each tooth is now sealed to the metal base and when all of the teeth of one section are thus attached, a hot blast from the chip-blower releases each tooth from its matrix and this section of matrices may then be removed. The teeth thus attached are now waxed more securely to the base along the buccal portion. The teeth of the remaining two sections are attached to the base in similar manner.

## CHAPTER XVII

## REPAIRING

**Replacing a Tooth When the Vulcanite Has Not Been Fractured.**—When a tooth has been broken from the base without fracturing the vulcanite, it is possible to replace the tooth in such manner as to make the new vulcanite invisible. A tiny flame directed by the chip-blower is projected against the remaining portion of the tooth, and this portion is warmed until it may be disengaged very easily. The mould number is obtained from the ridge portion of the tooth, and this enables an exact duplicate to be secured from the supply house. With a large-size, round bur in the handpiece, the vulcanite of the matrix is cut out as freely as possible without disturbing the margins (Fig. 266). A small piece of vulcanizable gutta-percha (red) is warmed

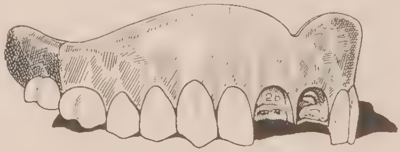


Fig. 266.—Drawing which emphasizes technic employed in repairing a denture, when teeth have been broken off without injuring visible portions of the vulcanite.

and ironed into the base of the matrix, with the use of the small end of a hot spatula. The matrix is not filled full—only about as much is used as has been cut out of the vulcanite with the bur. A small portion of the gutta-percha is warmed and pressed around the pins of the tooth. The labial surface of the tooth is passed through the flame, holding it with fingers or a pair of pliers, until the gutta-percha is very soft, when it may be placed in the position formerly occupied by the broken tooth. The incisal or occlusal edge of the tooth is placed against the bench and pressure is exerted against the denture until the tooth is forced into proper position. Any tiny portion of excess gutta-percha is removed with a hot sharp instrument. A slight film of wax is traced around the margin of the matrix to protect it during succeeding stages. Since none of the gutta-percha is allowed to show on the labial aspect, the original appearance is thus not disturbed.

**Investing and Flasking.**—The top is removed from an assembled flask ready to receive plaster investment, and the denture with the tooth which is to be vulcanized is supplied and the plaster jarred into the intaglio of the denture until all bubbles are expelled; the plaster should come into close contact with vulcanite at all points. (Wherever a bubble remains, a space will result in the plaster; this space will provide an opening into which the old vulcanite, when it becomes soft during vulcanization, may flow.) The remaining portions of the denture are supplied with plaster until the whole denture is completely encased. The flask is filled about two-thirds full of this same mixture of plaster and the encased denture pressed into it. The flask is then filled and the top pressed into place, forcing out the excess plaster. The case is then vulcanized and finished.

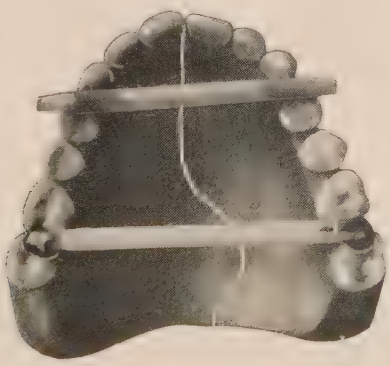


Fig. 267.—When the fractured vulcanite denture is assembled the pieces are held in position by means of matches attached with sticky wax.

**Repairing a Badly Fractured Vulcanite Denture.**—When the base of the denture is fractured, the pieces are assembled, one at a time, and, when in position, are securely fastened with the aid of sticky wax. This operation is often facilitated, especially in the case of the mandibular denture, by the use of a small stick or match. The ends of the match are both supplied with two or three drops of sticky wax and then the wax is rewarmed in the flame; this causes the wax to incorporate itself in the match and to hold more firmly when attached to the teeth. One end is sealed to the last molar on one side; when the opposite side of the base is assembled, the other end of the match is sealed to the opposite molar, thus serving to hold the fractured pieces in position. Sometimes, a second match—across the anterior portion—will serve very acceptably (Fig. 267). When the pieces

have been properly assembled, sticky wax is flowed over the fracture. With plaster a cast is made for the denture, and, when hard, the denture is removed in pieces from it.

**Old Vulcanite on Side Next to Tissues Is Left Undisturbed Except in the Labial Portion.**—The old vulcanite is prepared for the addition of the new rubber in such manner as to permit little or no new vulcanite to come into contact with the tissues. If the old vulcanite is left undisturbed on the side which will come into contact with the tissues, the adaptation will in all probability be undisturbed.

With a sharp instrument a line is marked upon the palatal side, eight or ten millimeters distant from each side of the fracture. The lines should be symmetrical, since they will outline the finished repair. With a square end large size fissure bur in a handpiece, the old vulcanite along each of these lines is cut out at least one millimeter deep,

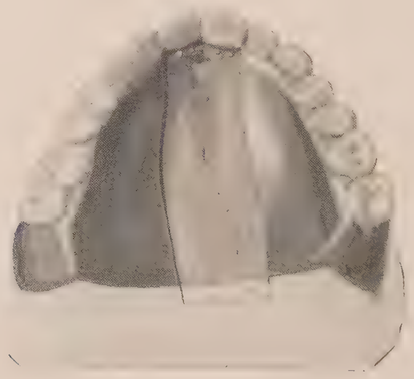


Fig. 268.—Palatal surface cut out to receive the new rubber. The diagram upon the posterior portion of the cast indicates the shoulders and type of bevel.

in such fashion as to furnish a sharp-angled shoulder against which to finish the new vulcanite. A similar shoulder is cut around the necks of the teeth against which the new rubber will be packed. After these shoulders are provided along the lines which have been marked, the remaining vulcanite between each line and the line of fracture is tapered down to a thin edge along the fracture. The tapering may be done easily with sandpaper arbor or with heatless stone; if the heatless stone is used, it is mounted upon a mandrel and used in the handpiece, or it may be used on the lathe in a specially adapted chuck. Fig. 268 is intended to show how the palatal surface is cut out to receive the new rubber. The diagram on the posterior portion of the cast shows the shoulders cut sharply and the remainder of the vulcanite on each side beveled toward the line of fracture.

The labial aspect of the anterior portion of the denture is left undisturbed, if this presents no ragged line of fracture; on the inner side of this border, the vulcanite is cut out with a bur, and beveled as described for the palatal portion, supplied with pink rubber and then backed with base rubber (Fig. 269). The cast at this point is covered with tinfoil (one one-thousandth of an inch thick) in order to assure a smooth finish when vulcanized (Fig. 270).

Dove-tailing of the old vulcanite is not essential.

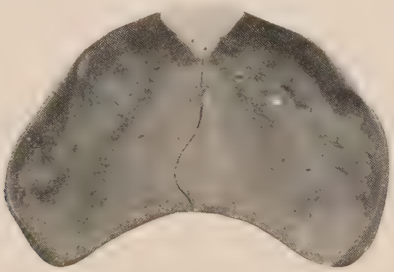


Fig. 269.—The anterior portion of the denture on its labial aspect is left undisturbed, but the inner side of the border is cut out and then supplied with rubber.

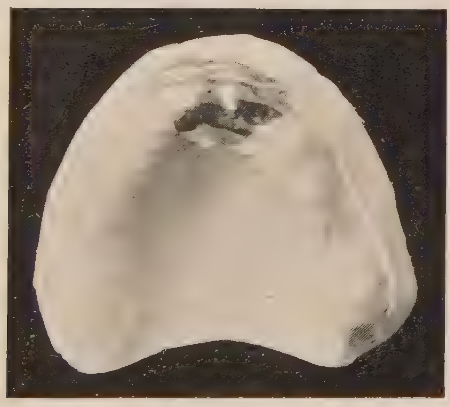


Fig. 270.—The cast is supplied with tinfoil in order to assure smooth finish of portion added to the intaglio.

**The New Rubber May Be Ironed into Place or Packed by Usual Method.**—After the cast has been supplied with tinfoil, the denture is placed upon it and the portion shown in Fig. 268, as cut out to receive the new rubber, is filled with base rubber, which is then ironed and smoothed with a hot spatula. If the spatula is kept clean, the rubber may be easily and firmly ironed into place.

If the anterior portion has been fractured so that new pink or granular gum facing must be supplied, this requires a complete re-

newal of the facing extending usually from the first molar on one side to the corresponding region of the other side. Fig. 271 shows one side prepared to receive the facing rubber; the other side has been supplied.

While the author prefers to iron the rubber into place as described, an alternative method is to employ the same principle in repairing as is employed in packing a case in the general course of construction. This requires that, with the pieces of the old denture assembled upon the cast, the palatal portion be supplied with wax; the wax is smoothed until it blends with the palatal surface as will be desired in the finished vulcanite.

**Flasking and Packing.**—The case is now invested in the lower portion of a flask and the plaster allowed to come up even with the incisal and occlusal surfaces of the teeth. The upper portion of the flask is

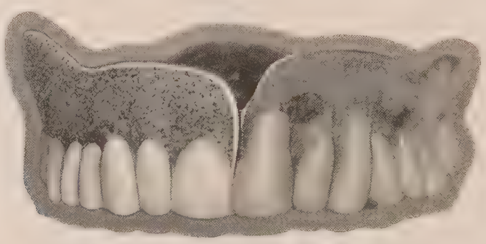


Fig. 271.—When the fracture requires new pink rubber, this is added from first molar to first molar; this figure shows one half prepared to receive new rubber and the other half with pink rubber ironed into position.

placed in position on the lower and filled with plaster. When the plaster is set, the flask is opened and the wax washed out and the old vulcanite further cleansed of any trace of wax by means of chloroform applied with a pledget of cotton. The case may now be packed with sufficient rubber to supply the portion of old vulcanite which was cut out. The flask is then closed and the case vulcanized.

"**Dry-packing.**"—On account of the difficulty that would be encountered in separating the flask, if the fractured *labial* portion were waxed, this part of the repair is taken care of by a method variously termed "dry-packing," "hand-packing," or "blind-packing." The difficulty that would be encountered in separating a waxed labial portion is due to the fact that the plaster would not separate out of the undercuts which would thus be formed by the teeth. In packing this portion, a hot spatula is employed to pack the new pink rubber into the labial portion. It is then coated with a very thin film of hot wax and a thin film is also put upon the new rubber at its juncture

with the plaster of the cast. This film is to prevent the investing plaster from flowing between the new rubber and the cast. Many operators prefer to "dry-pack" their cases throughout. This results in a considerable saving of time, but the method requires sufficient skill—and usually considerable practice—in order to iron the new rubber to the old vulcanite so as to secure the dense product which is given by compression in closing the flask.

**Flask Not to Be Opened Until Cold.**—On account of the haste usually desired in making repairs, it may be wise to warn the operator, that, while in vulcanizing, the desired temperature may be reached as quickly as possible, and that, when vulcanized, the vulcanizer and flasks may be cooled as quickly as possible, care should be exercised to avoid opening the flask before it is *stone cold.*

The case is finished after the regular method employed.

**Repairing a Hole in Gold Base.**—A small hole in a gold base denture may ofttimes be soldered with a high karat solder, without removing the vulcanite. The denture is placed in a shallow dish and the teeth surrounded with a mushy mixture of water and shredded asbestos to protect the teeth and vulcanite; the wet asbestos must not touch the gold base near the area to be soldered.

**Repairing a Hole in an Aluminum Base.**—An aluminum base cannot be successfully "soldered" because of the alloying base metals that enter into the composition of the solder. The hole caused by a stray particle of sand used in the investment or some foreign material may be closed with the solder, but the subsequent electrolytic action in the fluids of the mouth will disintegrate the metal.

An aluminum base soldered with aluminum solder constantly produces in the mouth a disagreeable metallic taste. The repair should be made with a piece of pure aluminum wire obtained from the sprue after casting (see Fig. 201). The author has never been successful in repairing holes in aluminum bases with the teeth attached. Such repairs are usually made immediately after casting when the need of repair is obvious. If the aluminum base is very thin its repair should not be attempted; the base should be remade.

The aluminum base is placed on an asbestos block and, if possible, that portion to be welded is supported by the block. A fine pointed flame, (Prestolite gas and compressed air) is directed upon the portion to be welded, while with the aluminum wire held securely in a pair of pliers, the surface of the aluminum is constantly scratched with the wire until the base begins to fuse; when this happens, the wire also

will fuse and by this scratching puddling action the operator attaches it to the base, closing the hole; the wire is melted off slightly above the base and removed. When the case is cool, the excess is removed from the base with a heatless stone, and the base finished in the usual manner.

# CHAPTER XVIII

## ARTICULATORS

**An Articulator Is Simply an Aid in Securing the Desired Occlusion.**—In the chapter discussing occlusion, the subject was presented without reference to articulators. "Occlusion and how to get it" would have properly indicated the contents of the chapter. No reference was made to articulators, and no reference was made to tools or mechanical aids of any particular construction, or to ingenious devices, however helpful an operator might find these to be. The author regards an articulator simply as an instrument which facilitates securing the desired relationships in the construction of artificial dentures. One of these instruments may be better than another, but the achievements of successful prosthetists—who differ in their advocacy of types of articulators—are sufficient warrant for the statement that no particular type of articulator is indispensable to the highest type of denture construction.

**Problem of Occlusion Is "Mental Rather Than Instrumental."**—Perhaps in no other connection is it more important to emphasize the fact that a knowledge of fundamental principles is more valuable and productive of desirable results than any number of tools or instruments or aids of the most precise or elaborate construction. The farmer lad, who knows the haunts and understands the habits of the fishes, may take a bent pin and a willow pole to bring home a string of beauties. The angler from the city with book of flies and split bamboo may return with empty creel. The dentist, who is versed in the anatomical relationships of the teeth in the opposing ridges, and who is fully acquainted with the physical laws involved in retaining removable bases in the mouth, may confidently be expected to construct upon barndoor hinges dentures that will more efficiently perform the function of mastication than will dentures constructed by an operator unfamiliar with the essentials of occlusion even though he use the best articulator to be obtained.

**Today, There Are Two Approaches to Problem of Occlusion.**—The problem of occlusion is approached today and its solution attempted in two ways, diametrically opposed. One of these ways gives evidence of attempting to preserve unbroken the Bonwill line of succes-

sion, placing emphasis upon geometrical ideals and mathematical calculations, down the decades to those who have devised elaborate mechanisms for measuring movements of the condyles and reproducing these in the process of constructing artificial dentures. From the author's viewpoint, studies of habitual movements of a mandible and tracings of its condyles' paths as an aid in the construction of artificial dentures are obsolescent. Further, he confidently believes that the date is not far distant when talk about condyle paths and their measurements will receive about the same treatment from prosthetists as the Ptolemaic theory of the universe receives in modern astronomical circles, and advocates will meet with the same kind of reception as is now accorded teachers who hold that the sun revolves about the earth, or who contend that the earth is flat.

**One Method Studies Forces, Ligaments, Muscles and Anatomical Principles.**—The second way of solving the problem of properly relating the occlusal surfaces of the opposing teeth, is through a study of the forces of occlusion, the limitations of the ligaments, the musculature involved, and the incorporation of the results of such study in artificial dentures, together with an application of the physical factors in retention of movable bases. A study of this kind results in the discovery that *the tactile sense of the tooth cusps is the guiding factor in movements of the mandible.*

**The New Idea of the Tooth Cusp as Guiding Factor Is Supported by Dewey, Wilson, and Prentiss.**—In keeping with the second method of approach towards a solution of the problem, significant studies of the temporomandibular articulation and its relation to occlusion have been made. Among others, Martin Dewey of New York City, H. J. Prentiss, Iowa City, Iowa, and the late George H. Wilson of Cleveland, Ohio, have made some noteworthy contributions. It was Dewey who first called the author's attention to the fact that prosthetists had not made use of the guiding factor of the tooth cusps, a factor so obviously employed in Nature's plans. The phrase, "the tactile sense of the teeth is the controlling influence of movements of the the mandible," belongs to Wilson and appears for the first time in dental literature in an article in the March (1917) number of the *Dental Summary*. Dewey's studies in comparative anatomy are related directly to this phase of the problem, in a discussion presented in the *Journal of the National Dental Association*, March, 1918. After calling attention to some anatomical investigations "which seem to indicate that the movement of the condyle is controlled by the occlusion of the teeth, or in other words, the shape of the condyle has

nothing to do with the movement of the mandible, but the condyle assumes a certain definite shape because the mandible has taken a certain movement,'' he said, ''I will also attempt to show you by a study of comparative anatomy that the mandible depends upon the occlusion of the teeth and in natural or artificial teeth the efficiency of the dental apparatus depends upon the occlusion of those teeth. * * *

'' * * * as animals develop and the masticating apparatus becomes more complicated, we find the shape of the condyle and the glenoid fossa has changed as the shape of the tooth has changed. These changes have been so positive that in a study of the comparative dental anatomy if you will give anyone who is versed in the science a tooth of any animal, he will be able to reconstruct and draw for you the temporomandibular articulation of that animal without seeing it. With a certain style of tooth, you will always have a certain type of temporomandibular articulation regardless of the nature of the animal.''

Prentiss in 1918 (*Dental Cosmos*, June) called attention to the deterioration of the meniscus due to loss of the teeth and in the *Journal of the American Dental Association* (December, 1923) presented more at length the anatomy of the temporomandibular articulation with reference to full denture construction.

**Viewing the Mandible as the Moving Part of a Mill.**—In the chapter on Physical Factors, attention was called to the suggestion of Wilson, that the masticatory mechanism of the human anatomy may be regarded as a mill, and in his presentation Wilson points out that the movements in milling are determined by the cusps of the teeth and that these movements are limited in extent and direction by the ligaments.

**Condyles or Tooth Cusps Determine Construction of Articulators.**—Anatomical articulators have been constructed according to the inventor's conception of the anatomy and function of the temporomandibular joint; such inventors have considered the masticatory movements as dependent upon the peculiar relationship and movement of the condyles with reference to the glenoid fossae. They have usually considered that the mandibular movements were determined by the movements of the condyles. It is therefore a Copernican reversal in prosthetic construction to view the movements of the condyles as determined by the cusps of the teeth. At any rate, an operator convinced of the greater importance of the cusps of the teeth in successful denture construction, will give more attention to cusp

relationships and less to measurements and tracings and relationships which primarily concern the condyles. Accordingly, in the construction of an articulator or occluding frame to aid in aligning the opposing teeth of maxillary and mandibular dentures, great concern may center about representations of condyles, or practically no attention may be given to them. The author believes that in the construction of articulators attention to condyles will lessen during the next few years.

**Function of the Ligaments.**—If the true function of the ligaments is kept in mind, it may be seen that an efficient articulator is possible, if it affords merely a frame to serve as supports for the casts, and

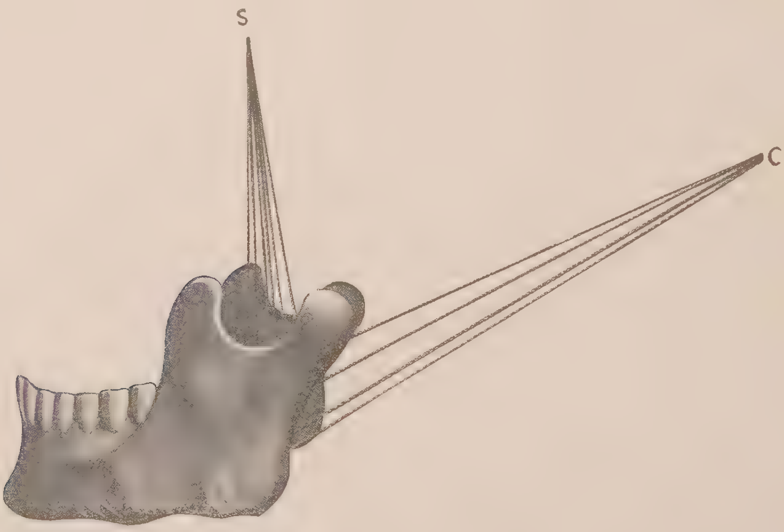



Fig. 272.—Schematic model of ligaments theoretically extended to cross at imaginary points "C" and "S," which inventors have incorporated in the construction of articulators.

provides a universal joint, together with some device to assure a return of movements to their starting point, which is usually central occlusion. Fig. 272 presents the sphenomandibular, the capsular and the stylomandibular ligaments in a schematic model used to show that the sole service of the ligaments is to limit the extent of mandibular movements. In this figure the mandible is shown protruded to the farthest limit. If these ligaments were extended imaginatively, they might cross at "C" which would be found near the occipital protuberance. If they were extended vertically in similar imaginative fashion, they would serve a similar purpose; in fact their extension to any point of an imaginary line connecting "C" and "S" would be just

as acceptable. We might also use these points and the lines representing the ligaments to assist us in the erection of triangles and in the construction of cones and spheres and other geometrical figures which might seize our fancy or somehow become connected with our trend of thinking; but such figures are not vital considerations in the construction of articulators; it is not essential that centers of movement have any anatomical or geometrical landmark. These theoretical extensions and geometrical constructions have been made by inventors who have incorporated these points as part of a universal joint supplied by them in their articulators.

**Use of Face Bow Has Only Theoretical Justification.**—Theoretically, the use of the face bow is justified, because those who recommend its use have previously accepted a theoretical vertical rotation center (it is a theoretical center although conceived by many as a real center). This center, for those who advocate the face bow, is located in a horizontal plane which passes through the temporomandibular joints. In reality, the opening and closing movements of the mandible have as their center, not a single fixed center but a series of centers due to the action of the condyles in partially leaving their original positions in the glenoid fossae as soon as the opening and closing movements begin. The fact that this adoption of a center is a matter of theory for the purposes of articulator or face bow construction is further substantiated by a study of the shifting rotation center involved in lateral mandibular movements.

**Articulator Need Not Incorporate Limitations of Ligaments.**—The rotation point or points of the human mandible will be determined by the planes of the cusps of the teeth, and will be limited by the ligaments; an articulator needs to be so constructed to permit such determination by the artificial teeth as aligned by the operator. Since the prosthetist is primarily concerned with rotation centers effective while the occlusal surfaces of the opposing teeth are in contact, his articulator does not need to incorporate a limiting device to correspond with the ligaments. Fig. 273 is intended to show that an articulator which is limited in its movements to such an extent that it describes only arcs of small circles, may be as efficient as an articulator capable of describing an arc of a much larger circle. In this diagram is presented the lines of an articulator having two oscillating centers such as the human mandible may be regarded as possessing. The arcs, constituting a Gothic arch, are such as the human mandible actually describes, arc OA from a center B, and arc OG from a center C; the arc XY described with a radius from center H may be such

as another articulator may be capable of describing. The latter articulator is not on this account more efficient for the prosthetist's use, since the masticatory movements of the mandible cannot avail themselves of the larger range of movement indicated by the dotted area.

The prosthetist is interested in the movements of the mandible primarily from the moment that two opposing cusps in masticatory movements touch until the mandible comes to a final rest position, or into central occlusion. This series of contacts of the occlusal sur-

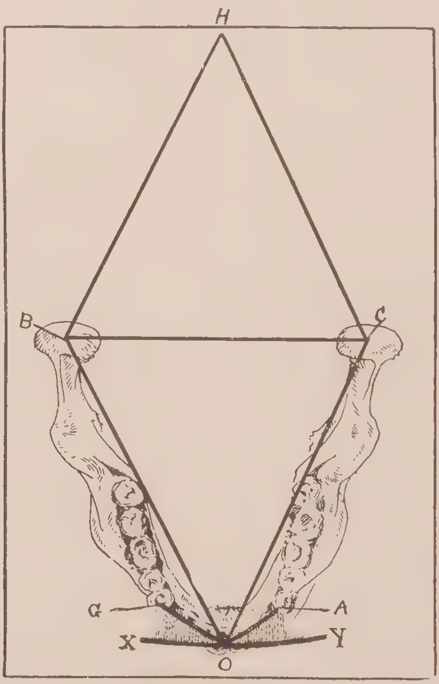



Fig. 273.—Diagram showing that articulators capable of describing arcs of small circles are as efficient in this respect as articulators capable of describing a complete circle. The masticatory movements of the mandible cannot avail themselves of the larger range of movement indicated by the dotted area.

faces which constitute the masticatory movements has been termed the functional occlusion of an individual case. The extent of this movement is in extreme cases four or five millimeters in the anterior teeth, two to three millimeters in the molar region, and about one millimeter in the condyle heads. Often the resiliency of the membranous tissue about the head of the condyle may be sufficient to account for the movement of one millimeter at this point. It may be observed that those who register varying markings of the condyle

paths, may note wide variations in inclination of the eminentia articularis, but for purposes of occluding the artificial teeth, only a small portion of the markings is selected, namely, those representing functional occlusion. It has been pointed out in the past, that condyle markings should really be registered during the masticatory or closing movements, because the opening movements—which in the past have generally been the ones measured by condyle registering enthusiasts—do not require the use of any of the muscles which exert stress during the process of mastication. A condyle exponent has recently constructed an articulator which is designed to register these closing movements.

**The Best Articulator for Any Operator Will Enable Him to Secure the Best Intercusping Relationship.**—The prosthetist is interested in articulators because their use will enable him to set up the teeth in both artificial dentures in the most acceptable intercusping relationship, and to grind them so that there will be no interference of cusps during the masticatory movements. The best instrument for an individual operator is the one which will best enable him to secure this relationship of the cusps and sulci of the opposing teeth so that there shall be perfect synchronization and harmony throughout.

**A Delusion of Some Inventors of Articulators.**—Inventors of articulators have often become very enthusiastic over the results which they have achieved in denture construction; but they tend to attribute their success to the superior type of articulator they have created. Some of them mount casts of natural teeth upon the articulator in order to show how perfectly the apparatus permits movements of the dentures in contact with each other. In their enthusiasm, they fail to note that the casts cannot do otherwise than move into central occlusion relationship, if allowed to follow the inclinations of the cusps.

**Simple Requirements of an Articulator.**—While one articulator may be more acceptable to one operator than another, any articulator may be used with satisfactory results by an operator who understands the natural occlusion of the human dentures and the physical forces indispensable to mastication and to retention—provided the articulator possesses three characteristics: First, it must permit opening and closing movements, that is, vertical movements; second, it must permit lateral movements; third, it must permit a movement corresponding to the retrusive and protrusive movements of the mandible. These three component movements of the process of mastication constitute the minimum. Certain additions, while not indispensable,

will facilitate the use of an articulator, and save the operator's time. A stop may be provided—such as is provided by guide cup and guide pin—in order that when the articulator is opened and closed, it will successively return to an exact position corresponding to the position of the mandible in central occlusion. With this stop, the operator is relieved of the strain of close attention or concentration otherwise required. A device for gradually and precisely retruding and protruding the lower bow will also facilitate its use.

**A Series of Articulators from the "Plain Line" to Lathe-Precision Type.**—The least serviceable articulator is the one which permits the least movement. A step removed from the least serviceable, i.e., a step away from the "plain line" articulator, is a plain line articulator in which a pin of smaller diameter is substituted for the hinge pin that was in the articulator while the teeth were being set up; this substitution permits some movement—the direction of which is limited but not determined—in addition to the simple opening and closing movements. The author got this suggestion several years ago from Dr. Greene, who through this substitution was enabled to use the plain line instead of an anatomical articulator. Then in the development of ideas of serviceable articulators follows a succession of eight or ten instruments varying in shape of condyles and in latitude of movements, besides improvements and attachments for these which have been supplied by others than the original inventors.

**Bonwill's, the First Anatomical Articulator.**—The first anatomical articulator was devised by W. G. A. Bonwill in 1858. It was designed to reproduce movements of the mandible. Other anatomical articulators have followed the principle underlying its construction, while only recently a patent was granted for an articulator designed "to provide dentures which determine the mandibular movement as distinguished from articulators which provide dentures to conform to individual condyle path movements."

**The Gysi Adaptable and the Gysi Simplex Articulators.**—The Gysi Adaptable Articulator invented by Alfred Gysi of Zurich, Switzerland, (described in his book, "Beitrag zum Articulationsproblem," published by Hirschwald, Berlin, 1908; this was translated and published in 1910, in *Dental Cosmos*), gave a new impetus to the construction of articulators designed to "reproduce mandibular movements." Due to the cost of the Gysi Adaptable Articulator, and to the complex methods required in its use, the Gysi Simplex Articulator, with its "average condyle paths" soon replaced it. The latter today

is probably the most widely used anatomical articulator (Fig. 274). It is manufactured by the Dentists' Supply Co., of New York City. Its popularity may be attributed to its serviceable character, simplicity of operation, long life, and low cost. The author has provided the Gysi Simplex with a lower bow attachment which affords a guide cup whose sides form an angle of 80 degrees (this angle is definite but wholly arbitrary), and by means of a thumb screw enables the operator to retrude and protrude the lower bow gradually and definitely. This attachment serves to incorporate in the use of the Gysi Simplex Articulator, ideas which are found in the Hall

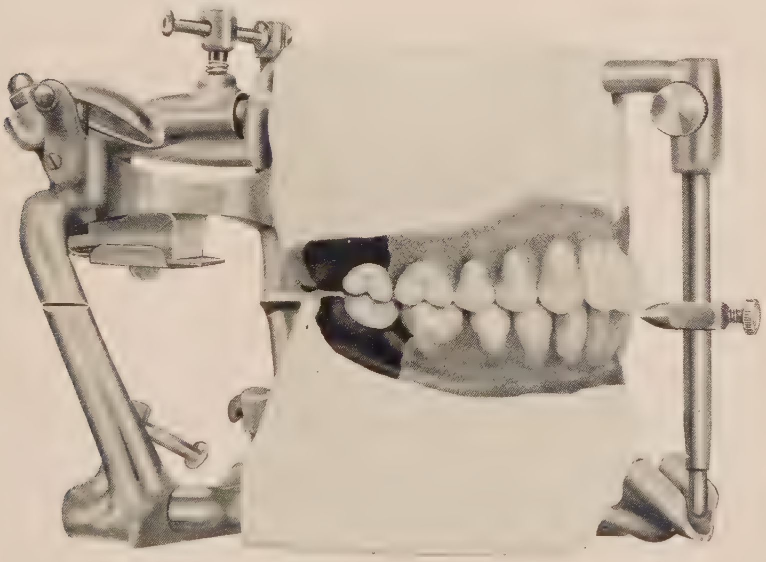


Fig. 274.—The Gysi Simplex articulator with teeth aligned according to the author's conception of the Gysi method.

Articulator. Fig. 275 shows the base of this attachment. Other views of it will be recognized in figures intended for other purposes.

**The Hall Articulator.**—Rupert E. Hall, now of Chicago, in 1914 produced an articulator in principle diametrically opposed to that which had been followed by Bonwill, Gysi, and others up to that time. He completely ignored condyle paths as a means of providing a guide valuable to the prosthetist in aligning the teeth of artificial dentures. Fig. 276 shows the Hall Automatic Anatomical Articulator that is now manufactured by the S. S. White Dental Mfg. Co.

**Monson's "Mandibulo-Maxillary Instrument."**—George S. Monson of St. Paul calls his articulator a "Mandibulo-Maxillary Instrument."

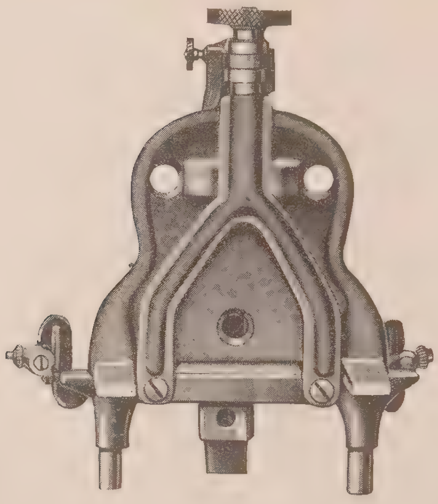


Fig. 275.—Attachment which provides the Gysi Simplex articulator with a guide cup having sides of definite angle, and with a device for definitely and gradually protruding and retruding the lower bow.

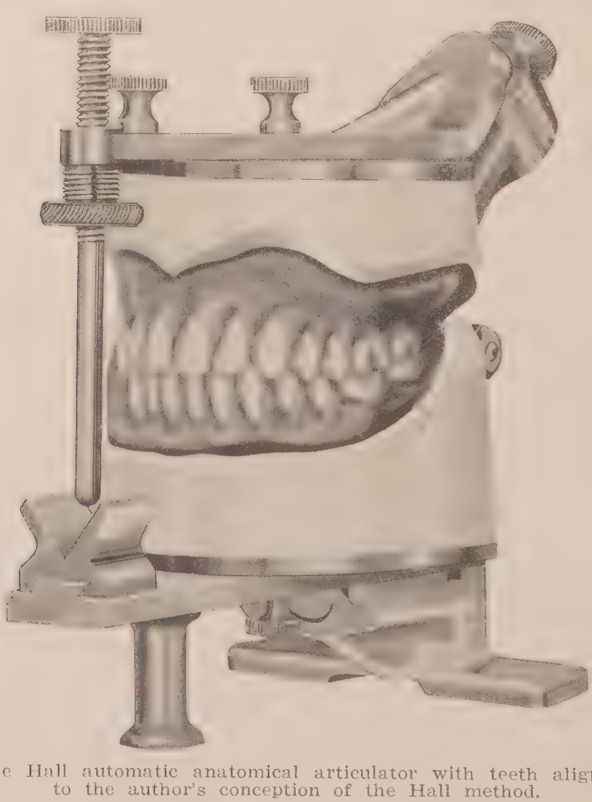


Fig. 276.—The Hall automatic anatomical articulator with teeth aligned according to the author's conception of the Hall method.

(Manufactured by M. F. Patterson Supply Co., St. Paul, Minn.) It is unique in that in it he has provided a mechanical center with reference to which the teeth of the mandibular denture are to be aligned. In keeping with his references to a sphere, somewhat after the fashion of Bonwill in referring to a triangle, he directs that these teeth be set upon the curve corresponding to an arc exactly four inches from the

Fig. 277.—The Monson mandibulo-maxillary instrument, with teeth aligned according to the author's conception of the Monson method.

center of a sphere (Fig. 277). Dentures constructed upon this instrument have a wider range of occlusion than that provided through the use of other articulators.

**Hanau Articulator Is Designed by Engineer.**—The Hanau articulator was designed by Mr. Rudolf Hanau of Buffalo, N. Y. Mr. Hanau is not a dentist but an engineer who through association with

dentists conceived of an articulator which is regarded as a development of the principle involved in the construction of the Gysi articulators. However, the condyle path measurements are registered during the closing movements instead of during the opening movements (Fig. 278).

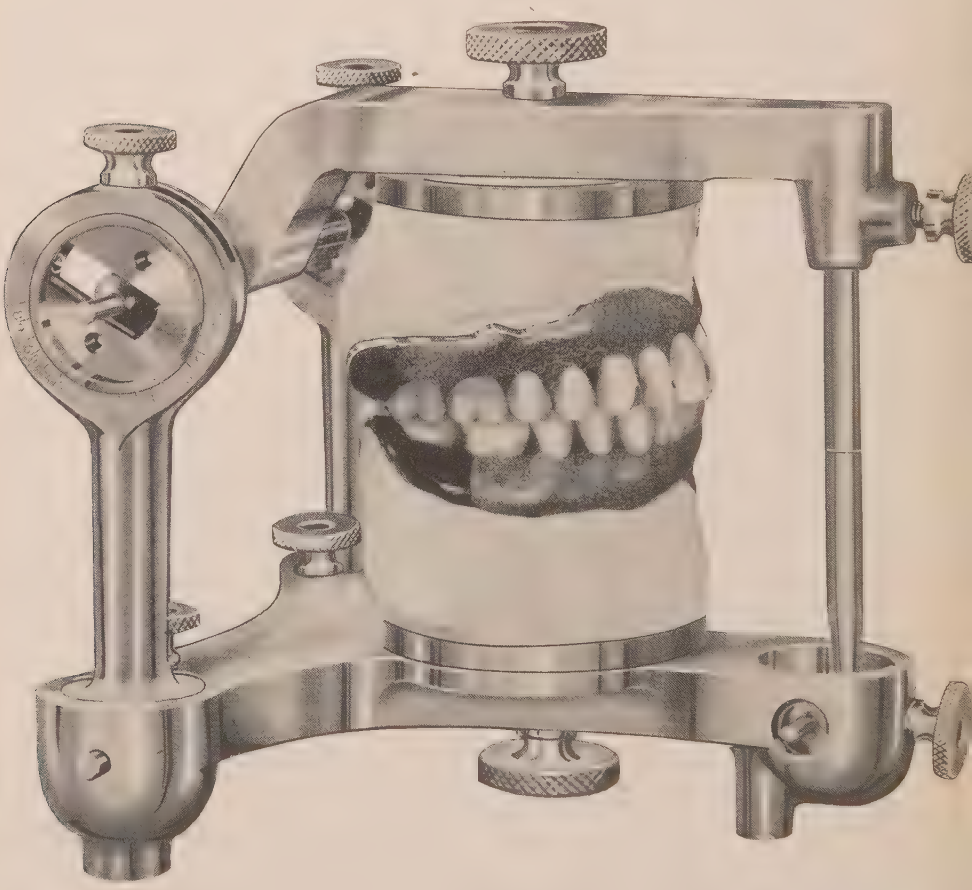


Fig. 278.—The Hanau articulator, with teeth aligned according to the author's conception of the Hanau method.

**Hall-House Precision Articulator.** M. M. House, formerly of Indianapolis, Ind., now of Kansas City, Mo., has improved the Hall articulator by means of ball-bearings and wear-compensating additions, with a view to insuring an accuracy in tooth cusp alignment and precise intercusping relationship, which he compares with the precision lathe. He says, "The work of the articulator is comparable to that of the lathe in that the milling or grinding of the planes

and facets of the teeth must be definitely and accurately cut in harmonizing and coordinating relation to each other in order to give proper balancing contact to the dentures and gliding smoothness to the cutting planes." (*Journal of the National Dental Association,* April, 1920.)

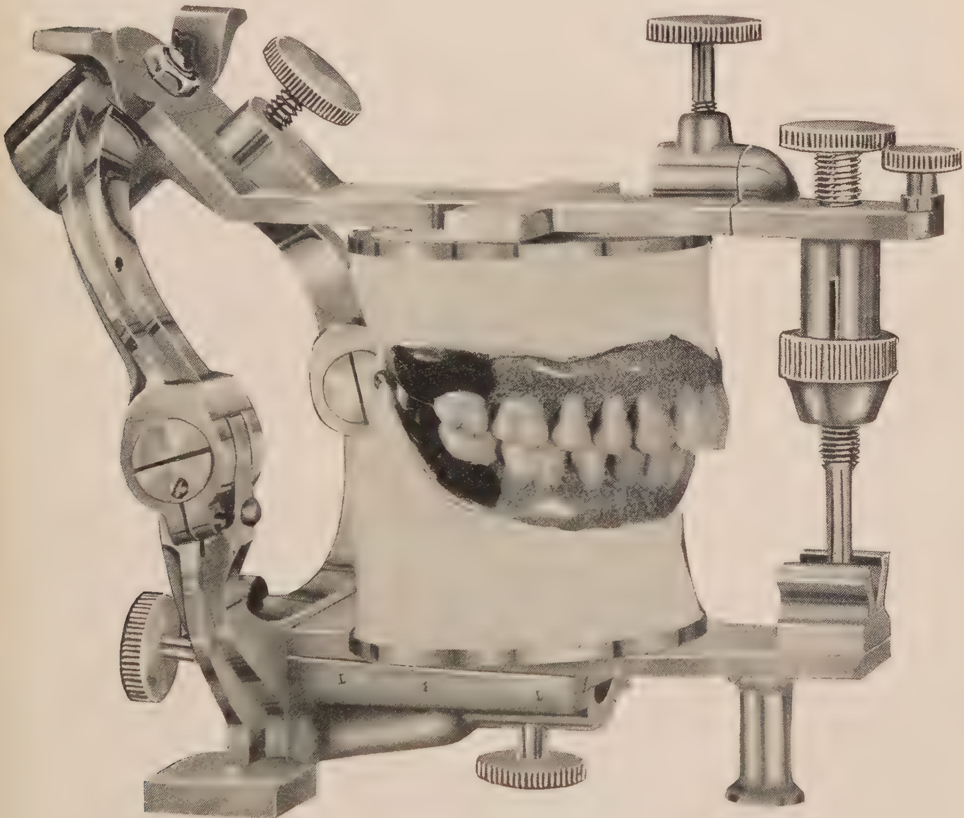


Fig. 279.—The Hall-House Precision Articulator; the dentures shown present the author's conception of mandibular teeth aligned to secure efficiency without regard to esthetics.

**Artificial Dentures Constructed with the Use of Different Articulators After the Technics of the Inventors Function with Equal Satisfaction to the Patient.**—The author has constructed for the same patient four sets of artificial dentures. In constructing these, he has employed, as fully as he has been able to comprehend them, the respective technics outlined by the inventors of the Gysi, Hall, Monson, Hanau articulators. The patient, a dentist, has some knowledge of efficiency, comfort and esthetics. He reports that he has no prefer-

ence so far as efficiency or comfort are concerned, although in the matter of esthetics he does find one set more acceptable than the others. All function satisfactorily but they do not all function alike. For example, Fig. 274 shows dentures constructed on the Gysi articulator. When the mandible is thus moved laterally, the mandibular cuspid passes through the angle formed by the mesioincisal edge of

Fig. 280.—Teeth aligned according to the Gysi method, shown in lateral occlusion.

Fig. 281.—Teeth aligned according to the Hall method, shown in lateral occlusion.

the maxillary cuspid and the distoincisal edge of the maxillary lateral (Fig. 280). Fig. 276 shows dentures constructed on the Hall articulator; when the mandible is moved in lateral occlusion, the mandibular cuspid makes such contact with the maxillary cuspid that a straight line drawn through the long axis of one tooth passes through the long axis of the other (Fig. 281).

## CHAPTER XIX

## MATERIALS

**Accelerators.**—

*Potassium Sulphate* ($K_2SO_4$), powdered not crystal form, added to plaster of Paris accelerates the setting and results in a harder product than is obtained with the use of salt. It is best to use it in solution; the amount used with a given amount of plaster is determined by the requirements of the operator.

*Warm water* hastens the setting of plaster.

*Spatulation,* vigorous or prolonged, contributes to the same result.

*Table salt,* or sodium chloride (NaCL), may be used but this is decidedly inferior to potassium sulphate.

**Acids.**—

*Boracic acid* is very acceptable for rinsing the mouth after teeth have been removed and while tissues are healing.

*Hydrochloric acid* (HCL) (muriatic acid) in solution of three drops of acid to eight ounces of water may be used to rinse the mouth free of ropy saliva. See also under Pickling Solutions.

*Hydrofluoric acid.* See under Pickling Solutions.

**Aluminum.**—See under Metals.

**Austin's Synthetic Stone.**—See under Cast Materials.

**Babbitt's Metal.**—See under Metals.

**Base Plate Material.** Base plate material such as Graft's, Alston's, Dentsply, and others is readily and easily adapted to the cast, remains rigid, is not affected by the temperature of the mouth, is not easily broken, and generally is more acceptable than most other materials of different texture.

**Borax.**—See under Fluxes.

**Boracic Acid.**—See under Acids.

**Burnishing Lubricant.** A film of equal parts of olive oil and bay rum is used as a lubricant in burnishing aluminum bases. It is applied to the exposed surface of the base and with a ball burnisher the entire surface is given a high polish. The author has found that a burnisher made of tantalum is much superior to one made of agate.

**Cast Materials.—**

*Spence's Plaster Compound* is one of the oldest and most reliable materials used in making casts. It has a minimum of expansion and contraction and has outstanding merit with respect to noncompressibility. On account of the last mentioned characteristic, it should preclude the use of plaster of Paris in making casts upon which dentures are vulcanized. Casts made of Spence's plaster compound are of sufficient strength to withstand the swedging necessary to perfect the adaptation of cast aluminum bases.

*Austin's Synthetic Stone,* while only recently placed on the market, is entirely satisfactory. Like the Spence cast, it withstands the stress incident to swedging.

*Healey's Artificial Stone* withstands the stress of swedging, but cheaper materials may be used for aluminum cases. It stands up under the stress of adapting and swedging gold bases in compensating for the contraction which takes place in casting.

*Brophy's Plastic Granite,*

*Ransom & Randolph's Model Stone,*

*Weinstein's Calcilith, and Dentolith,* are some among a number of other cast materials which the author has found to meet his requirements. However, the first three mentioned above have been used by him most extensively.

**Chloroform.**—Chloroform will dissolve rubber and is useful in securing a close union through enabling the operator to coat the surface with a thin film of rubber.

**Collodion.**—See under Fillers.

**Complaster.**—See under Plaster of Paris.

**Fillers.**—*Collodion* in ether solution is used both as filler and varnish; since it is inflammable, it should be kept away from the open flame. This must be used in sufficient quantity to permit immersion of impressions.

*Orange shellac,* which may be procured in solution from any paint store, is employed as a filler for the plaster impression before using sandarac varnish as a separating medium. The shellac as purchased should be diluted with an equal amount of denatured alcohol. Dry shellac, when cut with alcohol in the proportions of one ounce of shellac with four ounces of alcohol and then filtered may be used with results almost as satisfactory. Usually, the shellac gradually darkens in color as the coloring matter is extracted from the handle of the brush used in applying. If followed with a sandarac coating

as a separating medium, shellac is unfailing in furnishing a smooth cast, especially a cast poured of artificial stone.

The *water* contained in a plaster impression that is still moist, constitutes the filler, when silex is used as a separating medium.

**Fire Clay.**—Fire clay of a grade suitable for use in the repair of the muffle of an electric furnace may be obtained of the Denver Fire Clay Co., Denver, Colo. It is marketed in powder form, which mixed with water may be moulded and applied as desired.

**Fluxes.**—

*Borax and saltpeter* in equal parts is sprinkled upon the scrap gold as it is being melted into a nugget, in order to clean it.

*Ney's Oxidizing Flux* may be used in cleaning the gold, and the odor arising is not so offensive as that when borax and saltpeter are used.

*Borax,* which may be conveniently obtained in packages of the "Twenty Mule Team" brand, is used in soldering gold. After scrap gold is formed into a nugget or button for casting purposes by means of borax and saltpeter, then borax may be used in melting it when casting.

*Reducing fluxes* for use in fusing special formula casting golds are supplied by the manufacturers of the various golds.

**Golds.**—See under Metals.

**Grinding Materials.**—

*Carborundum Powder.*—In grinding artificial teeth to perfect the occlusion while on the articulator, carborundum powder—No. 90 to 120 grit—is used with glycerin. The paste thus formed is applied to the morsal surfaces of the teeth and, when the grinding is completed, it may be washed off easily with water. The powder may be obtained from the hardware store; it is distinguished from emery powder by its sheen. Emery powder is blacker and is not so effective as an abrasive.

*Pumice stone* and water are used in a similar manner as a finishing abrasive after carborundum powder has been employed.

**Investment Material.**—A good grade of investment material should be used in order to avoid misfortune that may easily befall an operator's efforts if he is working with inferior material. There are many good investment materials available, but the operator will find it far more economical to make his own. To be satisfactory, an investment should be firm when set and not easily broken, heat-resisting, and sufficiently porous to allow the escape of steam while drying out and to allow the escape of air during the casting process. The ideal ma-

terial would neither expand nor contract—the best material approaches this ideal as closely as possible. In order to get the desired degree of integrity, plaster is used (this is true of all investments); porosity is secured through the use of sand, which also provides the desired heat-resisting quality; silex, also heat-resisting, gives a smoother cast. The author has employed for a number of years investment made after the following formula: plaster of Paris, two pounds; sand, three and one-fourth pounds; silex, one and one-fourth pounds. The plaster is the best quality that may be obtained from a dealer in builders' supplies. The plaster ordinarily obtainable from dental supply houses is too highly calcined; it has remained in the furnace or kiln so long during the process of manufacturing that some of the desirable qualities have been burned out, leaving it finer in texture but less suited for our purpose. The sand is known under the trade names of white lake sand, glass grinders' sand, tile-setters' sand, and McComb sand. It may be obtained from some dealers in builders' supplies and from the larger dealers in plate glass; it should always be sifted to insure the removal of foreign particles or any coarse sand that may have become mixed with it. The silex is the XXXX brand used by painters as a filler for hardwood floors and is carried in stock by all paint houses. These ingredients should be thoroughly mixed and well shaken together.

The investment, formula of which is given in the preceding paragraph, when ready for use, should be mixed with water and thoroughly mixed—more thoroughly than one is accustomed to mix plaster and thicker than plaster is ordinarily mixed—and it should be poured just at the moment it shows a tendency to set.

**Iridioplatinum.**—See under Metals.

**Metals and Solders.**—

*Aluminum.*—Silicate of aluminum, or common clay, is found in nearly every locality. It is also found as an oxide. Commercial aluminum is obtained by electrolytic process and may be purchased 99.8 per cent pure in ingot form. As a conductor of heat it compares at 31.3 with silver at 100 and gold at 53.2. It is preferred to silver because it withstands better the fluids of the mouth. The Aluminum Company of America, Niagara Falls, New York, manufactures pure aluminum and sells direct to the small consumer. The operator will wisely refrain from remelting aluminum and will thus avoid the effects of deterioration possible through contamination of the metal. Some supply houses purchase aluminum and melt it to provide smaller ingots for casting purposes. For that reason it is

usually safer to purchase direct from the manufacturer. With the exception of magnesium it is the lightest of metals (specific gravity 2.6). Contrary to general opinion it is heavier than vulcanite. It melts at a temperature of about 1215° F.; variation in temperatures quoted by different authorities is probably due to contamination during the determination of melting point.

Aluminum is not easily soldered and an *aluminum base should not be soldered*, since any alloy may subject the base to disintegration through electrolytic action in the fluids of the mouth. Autogenous welding takes the place of soldering. In welding, the hole should be thoroughly cleaned and the blow-pipe used to warm the entire base, especially the portion around the hole; the flame is then directed alternately upon the base and the piece of aluminum—the wire cast as an auxiliary sprue is especially adapted—and at the moment of melting a steel instrument is used to puddle the aluminum and thus to make it an integral part of the base. A hole in the base sometimes results through imperfect technic in casting. Imperfections in technic which may thus result and which suggest their own method of avoidance are discussed in the chapter on "Cast-Swedged Aluminum Base Dentures."

Pure aluminum (99.8 per cent) does not deteriorate in the fluids of the mouth. A few years ago both the inferior grade of aluminum used and the swedging methods employed resulted in bases which after a few months' wear became pitted with small holes. The author finds the cast-swedged aluminum base more acceptable than a base swedged from an aluminum blank, principally because ample retention of the vulcanite may be easily provided in casting while equal retention of vulcanite cannot possibly be provided when blanks are used. Since tin is compatible with aluminum, a thin layer of weighted (with tin) rubber is used next to the base; the weighted rubber together with the aluminum loop attachments prevent the vulcanite from leaving the base; in this respect there is no superiority of a vulcanite base over a metal base.

The stain from vulcanizing may be removed with the use of a small pledget of cotton dipped in hydrofluoric acid, after which the base should be washed in a solution of bicarbonate of soda (baking soda) to neutralize the acid and then washed in running water. For the same purpose, alkaline preparations, such as Eagle Brand Lye, in saturated solution may be used. The solution should be warmed and the base momentarily immersed in it and then washed in running water.

In 1908 the author began to cast aluminum bases. At the present time he still continues to cast them and his experience with the results for more than fifteen years compel him unequivocally to prefer and recommend aluminum base dentures rather than those of vulcanite.

*Babbitt's Metal* (Haskell's Formula) is an alloy of copper one part, antimony two parts, tin eight parts. It melts at about 500° F. It is used in making a metal die upon which to swedge the platinum base. The metal according to Haskell's formula is usually stocked only by dental supply houses.

*Gold.*—Pure gold may be used in soldering platinum and iridio-platinum, but there must be absolute contact of the parts to be soldered. In the form of gold foil or mat gold it is used in filling artificial teeth.

Casting golds made according to special formulas are featured by practically every gold refiner. All of them have merit, but it will be found that any standard 20 K. plate gold will give satisfactory results. Many of those specially recommended by the refiners are too unyielding to allow for swedging necessary to correct the shrinkage which occurs in casting. Gold coin obtained from the bank and alloyed with silver is very acceptable. A $20.00 gold coin alloyed with a silver dime produces gold of approximately 20 K.

*20 K. Solder.*—Sometimes the soldering of a tiny hole in a cast base will obviate the necessity of casting another base. If for this purpose gold solder of the same karat as the casting gold is employed, the repair will be invisible.

*Iridioplatinum wire* is made of platinum alloyed usually with 10 per cent or 15 per cent of iridium. Iridium belongs to the same group of metals as platinum, is much harder and possesses greater tenacity than platinum. On this account it is valuable in strengthening the pure platinum base. Pure iridium fuses nearly 300 degrees higher than pure platinum. The oxy-acetylene blowpipe is employed.

*Platinum* is a very soft metal usually obtained in placer deposits in rounded grains, flakes or pellets. On account of its low co-efficient of expansion (.0009) it is especially valuable for the pins of porcelain teeth, the expansion of platinum and porcelain being nearly the same. Platinum fuses at about 3232° F. Pure platinum plate of the desired gauge and degree of softness for the prosthetist's purpose may be obtained of the refiner of metals. In adapting to the cast the process required will harden it somewhat but the original softness may largely be restored by annealing in the gas oven in which flasks are burned out. Annealing does not require an extremely high temperature.

*Pure platinum wire* is used in wiring electric furnaces. Because of its high fusing point and its low rate of conductivity of electricity (14.5 compared with silver at 100) it is highly desirable for this purpose.

*Platinum solder* is composed of 25 per cent platinum and 75 per cent pure gold. It may be obtained from the dealer or is easily made by melting the gold and feeding into it strips of platinum $1/2000$ of an inch thick.

*"Rhotanium"* is a trade name for an alloy of gold and palladium used as a substitute for platinum. The author uses it instead of platinum solder because of the ease with which it may be built up in contouring and, since it fuses at a higher temperature than platinum solder, it will not bake out or shrink during the process of fusing the porcelain. It may be obtained from the Rhotanium Company, Cuyahoga Bldg., Cleveland, Ohio. Rhotanium "C," melting point 2570° F. is the grade employed in continuous gum dentures.

*Tin* in the form of sheet foil (No. 4 which is one-one thousandth of an inch thick) is used to cover the cast in the construction of vulcanite dentures, in order to give the vulcanite a smooth case-hardened finish.

No. 60 sheet foil is used in one or more thicknesses over the raphe of the cast in order to prevent undue pressure of the base of the denture upon this area. Patterns are cut of this tinfoil when ordering platinum plate for platinum base dentures.

**Modeling Compound.**—Different modeling compounds vary in their formulas, but practically all of them are made of resinous gums, French chalk and stearin. The gums provide the plasticity, the stearin controls the action of the gum and the chalk serves as a stabilizer. Flavoring material is sometimes added. Most of the valuable resinous gums are found in the tropical regions, some of them being dug out of the ground from the remains of trees that have long since been fossilized, while some are obtained in a manner similar to that employed in getting caoutchouc. Some are too sticky if used alone, some are too hard, but combined in proper proportions they provide the desired stickiness and fusibility for the mass. A resin mixture soft enough for impression-taking is too sticky and too slow in setting and has no definite melting point. Wax is added as a control; stearin is used for this purpose. Stearin is the solid residue remaining after pressing the liquid portion from the mixtures of liquid and solid fatty acids resulting from the hydrolysis of oils and fats. Stearin melts to a mobile liquid at about 128° F. The talc or chalk reduces the

shrinkage, lessens stickiness and renders the mass of a consistence suitable for practical use. An oil-soluble dye is used for color.

The brands of modeling compounds in most common use are the S. S. White's Impression Tray Compound and the Kerr's Perfection Impression Compound. The former is black and is used largely by operators for the construction of individual impression trays; the Kerr's is used by operators who employ modeling compound without the aid of plaster in taking impressions, and also in partial denture construction. The Kerr's compound in stick form is conveniently adapted for use, as indicated elsewhere in this book, in post-damming and peripheral adaptation.

"Nebo" impression compound, designed for use with the Bowen-Neil technic of securing lower impressions, contains more resin than most other compounds, softens more easily and fractures with a clean fracture.

**Mineral Stains.**—See under Porcelain.

**Pickling Solutions.**—Pickling solutions are solutions employed usually to remove oxides from metals. For gold, commercial hydrochloric acid (HCL) with equal parts of water is employed. The gold while hot is momentarily immersed in the acid and then washed in clear water.

Hydrofluoric acid (HF) is used in commercial solution undiluted for removing fused silicate from gold castings and from iridioplatinum wire. It is also used on a pledget of cotton for etching aluminum bases; its action is neutralized with baking soda which is easily washed off in clear water.

Aqua Regia is a solution of concentrated hydrochloric acid, nitric acid and water. It is used for removing base metal pins from teeth preparatory to supplying these teeth with iridioplatinum wire pins for use in continuous gum work. The author uses a mixture of two parts of commercial hydrochloric acid with one part of commercial nitric acid.

**Plaster of Paris.**—Plaster of Paris is made by burning the mineral, pure gypsum, which is a hydrous sulphate of lime, the chemical formula of which is $CaSO_4 + 2H_2O$. By burning at a temperature, varying according to the method, from 212° F. to 400° F., a portion of the water is driven off and the gypsum becomes plaster of Paris, the formula of which is $CaSO_4 + \frac{1}{2}H_2O$. The quality of plaster of Paris used by dentists varies and is dependent upon the extent of burning and hence the amount of moisture remaining, upon the degree of

fineness, the constancy in treatment and freedom from foreign substances.

The best plaster of Paris for the dentist's use is that which has the least expansion and contraction. In the author's experience, Kerr's Snow White Plaster is the most reliable in constancy; it contains no accelerator and shipments vary only slightly in their setting qualities. The author employs Kerr's plaster for impression-taking and, on account of its whiteness, also for study casts. For all other purposes such as boxing, flasking, luting, and as a binder in homemade investments, he uses the finest grade of plaster that can be obtained from a dealer in building supplies. The latter is coarser, sets more quickly, and is stronger.

Modern methods preclude the use of plaster of Paris for making casts which must withstand the compression incidental to closing the flask and to the expansion of rubber during vulcanization.

*"Complaster"* manufactured by the Dental Products Company of Chicago, is a proprietary mixture composed of impression plaster, potato flour and coloring matter. The coloring matter is to make it easily distinguishable. The chief merit of this mixture lies in the fact that after setting it is easily disintegrated with the use of hot water. This characteristic makes it desirable as a material for pouring models for metal dies. The author uses it only in this connection. In disintegrating this material after setting, the water should approach the boiling point. If allowed to boil, the potato flour is agglutinated until removal is difficult.

**Platinum.**—See under Metals.

**Polishing Materials.**—

*Pumice* is of volcanic origin and its fineness depends upon grinding and upon the mesh of sieve used in preparing. Medium fine quality is best for vulcanite. It is mixed with water and used with brushes, rag or felt wheels, and felt cones.

*Rouge* (Oxide of Iron) is used to give a final polish to metal bases. Ammonia is a solvent for this material and may be used to cleanse it from the base when finished. It may be obtained in stick form and in this form it is used without water or other fluid, in connection with the same kind of equipment as used with pumice.

*Silex,* the finest grade only, may be used instead of whiting or French chalk. It is mixed with water and used in the same manner as pumice.

*Whiting* or French chalk is in texture more smooth and more suitable than pumice for finishing. It is mixed with water before applying.

**Porcelain.**—The porcelain of which artificial teeth are made is composed of a body of feldspar, silica, and kaolin or clay, with potassium and sodium as fluxing material, together with pigmentary substances. These are combined according to the manufacturers' secret formulas and moulded in brass moulds; the mould is clamped tightly together and heated on a stove until very hot, after which the teeth may be removed and trimmed with the aid of fine files. They are then heated and afterwards baked in the furnace until properly glazed, which usually requires about fifteen minutes.

*"Rubber" or "vulcanite" teeth* are those provided with pins designed to secure them in their attachment to the vulcanite. The "pin-guard" of the incisors and cuspids is the shoulder between the pins and the incisal edge, to which the vulcanite may be finished. The

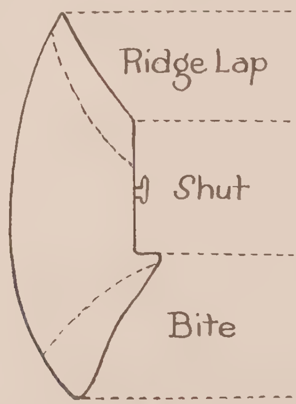



Fig. 282.

"ridge-lap" of a tooth is that portion which is placed in contact with the ridge. The "bite" or "overbite" of an incisor or cuspid is that portion between the "pin-guard" and the incisal edge. The "shut" of the jaws is the distance between the jaws when they are in correct position for the occlusion of the artificial teeth. A "long shut" tooth is one designed to fill a comparatively long space; a "long bite" tooth is one in which the distance from the "pin-guard" or porcelain shoulder to the incisal edge is long. (Fig. 282 suggests method of grinding a tooth to the different forms.) A long bite tooth is always preferable from the standpoint of esthetics, wherever it may be used; the increased length of the bite increases the translucency. It may be cut down with the carborundum stone to a short bite tooth, and if necessary the ridge-lap may be lengthened by grinding so as to include a portion of the "shut."

*Diatoric or "pinless" teeth* are provided with holes into which the rubber flows and, when vulcanized, attaches them to the base. This method of attaching is entirely satisfactory in the case of posterior teeth.

*Continuous Gum Teeth.*—The entire stock of Trubyte teeth is made available for continuous gum dentures by supplying each tooth with an iridioplatinum wire pin as described on page 302.

*Powdered Porcelain.*—Allen's "Continuous Gum Body" is used for the body or main bulk of porcelain in continuous gum dentures. It fuses at about 2100° F. Close's "Gum Enamel" porcelain is used for the final bake of the continuous gum denture. It fuses at a temperature slightly below 2100° F.

Brewster's "Low Fusing Porcelain" and S. S. White's "Medium Fusing Porcelain" are used in repairing fractured teeth of continuous gum dentures. These fuse at about 2000° F.

Porcelain which fuses below 2300° F. is called low-fusing; that which requires 2300° F. or above is called high-fusing porcelain.

**Mineral Stains.**—Mineral stains are made of mineral colors (metallic oxides for the most part) incorporated with a body of material similar to porcelain. The powder is mixed with oil of cloves or some other of the essential oils which serves merely in applying. The stain glazes as a surface stain and consequently is not intended to change the color of a tooth to match another artificial tooth, the pigmentation of which is in the body. The stains are used in imitating the imperfections and peculiarities of natural teeth.

**Presto-lite.**—"Presto-lite" is a trade name for acetylene gas as supplied in portable tanks of various sizes. Used in conjunction with compressed air the flame serves every practical need of the full denture prosthetist, except in connection with continuous gum cases.

"**Protesyn.**"—Protesyn is a silicate cement used instead of facing rubber for better esthetic effect. Owing to the flexible character of vulcanite and the chemical action of aluminum, protesyn is more successfully used as a facing for gold base dentures. And even with gold base dentures the patient should understand that the protesyn must be renewed at the end of each ten or twelve months' period. This material must be kept moist after it is applied, and the patient if not wearing the dentures must keep them in water. Instructions which make the application of this material easy are supplied by the manufacturers, the L. D. Caulk Company of Philadelphia.

**Rhotanium.**—See under Metals.

**Rubber.**—*Crude rubber, or caoutchouc,* in the form of a watery milk-colored fluid is obtained by making incisions in the bark of many tropical and semi-tropical trees. By various methods the rubber is coagulated, and then purified preparatory to use by the manufacturers. Combined with sulphur and subjected to a temperature of 320° F. for a given period of time the rubber becomes vulcanite and is then capable of resisting the usual solvents of crude rubber and is not affected by cold or heat below the vulcanizing point.

Vulcanite is susceptible of a high polish, and, if properly vulcanized, is very dense. It is a poor conductor of heat and cold and so not always compatible with tissues upon which it is worn. It expands more than four times as much as zinc, which is the most expanding of metals.

*Base rubber* is designed with a view to providing the greatest strength. In packing a case the operator should be sure that this rubber engages the pins or holes in the teeth.

*Facing Rubber.*—Rubber used to resemble the color of the gum tissue is usually pink and for that reason rubber intended to be used as facing is usually referred to as "pink" rubber. On account of the coloring matter and filler used in the facing rubbers they do not have nearly the strength that base rubbers have, and care should be taken to see that no tooth depends upon the pink rubber for attachment to the base.

*Granular Gum Rubber.*—Pink facing rubber is given a granular effect by the use of tiny white and red flakes distributed throughout the pink rubber body in pleasing proportion. Since this kind of surface breaks up the rays of light more nearly as the tissues themselves do, the esthetic effect is heightened considerably through its use. However, unless properly treated in the process of manufacture, it disintegrates after the denture is worn for a year or more. "Walker's Granular Gum" obtained from Ash & Sons, New York, is preferred by the author.

*Velum rubber,* on account of the increased amount of sulphur contained in it, vulcanizes as a soft pliable vulcanite instead of with a hard flexible finish. In rare instances this rubber is used to provide a base affording greater comfort than is possible under certain conditions with hard vulcanite.

**Separating Fluids.**—

*Sandarac* separating fluid made of one ounce gum sandarac with four ounces of alcohol and filtered through filter paper provides a sur-

face impervious to air or moisture. It is applied upon the impression after the shellac filler has dried.

*"Parting Fluid"* is manufactured by the S. S. White Mfg. Co.

*"Separlac,"* manufactured by the Ransom & Randolph Co., is extensively used.

*Liquid Silex,* or sodium silicate, also known as waterglass, when diluted with an equal amount of water, may be employed as a separating medium if the impression is to be poured with plaster of Paris. For best results the silex should be applied while the impression is still moist. This medium is also used in order to facilitate separation of the parts of a flask.

*Soap.* A thick lather of Ivory soap may be used instead of silex.

**Strengtheners.**—

*Soft iron wire,* about 12 gauge, is cut to proper lengths and contoured to fit the mandibular metal trays and thus be imbedded in the compound used in making individual impression trays of compound. If these strengtheners are flattened upon the anvil they will become more firmly imbedded in the compound. They are also employed in the bases of mandibular occlusal rims, especially when these are to be worn.

*Iridioplatinum wire* is used to reinforce the platinum base before the porcelain is applied.

**Sandarac.**—See under Separating Fluids.

**Stains.**—See "Mineral Stains" under Porcelain.

**Tape.**—Physicians' adhesive tape is employed upon the cast used in the construction of a metal base, just as tinfoil is employed in vulcanite cases to relieve the hard areas of the mouth from pressure that is exerted in the course of mastication.

**Teeth.**—See under Porcelain.

**Wax.**—*Beeswax* is made from the honeycomb produced by bees. The bulk form which may be purchased from the farmer is unadulterated and more suited to the prosthetist's purposes of securing central occlusion when a number of teeth remain in both upper and lower jaws of the patient. It melts at about 175° F. and will dissolve in oil of turpentine, ether or chloroform.

*Yellow Base Plate Beeswax* (thin) in sheet form manufactured by the S. S. White Mfg. Company is very acceptable in forming the wax pattern for an aluminum base.

*Base Plate Wax* (usually pink) is the name applied to paraffin sheets which once were very unsatisfactorily employed to form bases

upon which occlusion rims were constructed. It is now used for the upper portion of occlusal rims, the bases of which are constructed of some more substantial material; it is also employed in sealing the teeth in position and in forming the contour of the wax pattern. The operator will wisely select for his use a brand which does not leave a residue when a portion is held on a spatula in the flame, and which does not leave its color on plaster or investment when boiled out.

*Thin Sheet Wax* of 30, 28, 26, 24, 22 gauge, prepared by the Detroit Dental Manufacturing Company is especially suitable for use in the construction of patterns for cast gold bases. The 28 gauge is usually sufficient; when a greater thickness is desired, two thicknesses are employed.

*Sticky Wax* is a wax which contains a preponderance of resin. It is used for holding in apposition portions of broken casts and dentures, and in assembling impressions.

*Carding Wax* is the black wax upon which the manufacturers card the teeth for display purposes or convenience in marketing. It is very easily softened, hardens slowly and melts at the lowest temperature of all of the waxes used by the dentist. The author uses it in post-damming and in perfecting the adaptation of the peripheral borders of an impression. A wax that may be used for these purposes may be made by the addition of a small percentage of lard to pink base plate wax; one part of lard to six or seven parts of wax, depending upon the climate.

# CHAPTER XX

## SUGGESTIONS TO WEARERS OF ARTIFICIAL DENTURES*

These suggestions are offered in order to assist you in deriving all of the satisfaction possible in the wearing of your dentures. Your dentist has given you the best that he is able to give you in view of the condition of your mouth and of your selection from the materials which may be employed in constructing dentures.

Whether the condition of your mouth was favorable or unfavorable to the retention of artificial dentures, and whether the material upon which the teeth are based is gold, aluminum, vulcanite, or platinum, these suggestions faithfully followed will aid you more quickly to enjoy satisfaction in the wearing of your dentures.

**Comfort.**—Seldom are close-fitting shoes comfortable when worn for the first time. In rarer instances are dentures comfortably worn when first inserted. In both cases adaptation is necessary. Shoes may stretch somewhat, and the feet may change slightly to conform to the AA last, but dentures do not change, and the process of adaptation belongs wholly to the tissues of your mouth. This adaptation takes place more quickly if your dentures are worn continuously night and day. They may be removed as often as you wish to cleanse them or to freshen the mouth with hot salt water or with some proprietary mouth-wash.

Since you are not accustomed to your new dentures, do not start upon a visit immediately if you can avoid it. Do not hurry to get your dentures just before some social function, or because you have accepted an invitation to dinner; rather, wear your new dentures first on your busiest day. If you are busy you will have less time to think much about the discomfort which you may experience.

If these are your first artificial dentures, return to the office within thirty-six or forty-eight hours at the most, in order that examination and minor corrections may be made. Since you have worn your dentures continuously, any irritation will be easily detected and relieved. While these corrections are easily made, let the dentist make them; you may be in error as to the point at which correction should be made. If your upper denture seems too long, and the sensation pro-

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duced by it is extremely disagreeable, you may usually get rid of the sensation with a gargle of peppermint water.

**Esthetic Appearance.** Your appearance is different unless effort has been made to reproduce your natural teeth. You liked the size, form, and hue of the teeth before the dentures were finished. Don't change your mind now. Changes are expensive. Whatever the change, some of your friends will not approve of it any more heartily than they approved your choice of a suit. Even though you are more attractive, some of your friends do not like it. You will soon grow accustomed to the improvement, and your friends will like it when they have become accustomed to it.

Don't discuss your dentures with anybody but your dentist until you have begun to forget that you are wearing them.

**Efficiency.**—When a person puts on roller skates for the first time, he is hardly qualified to enter a race; he does well to stand still. The first day that a man wears an artificial leg he is unlikely to be a desirable partner in a modern dance. Both the skater and the wearer of an artificial limb must learn.

Wearers of artificial dentures must *learn* to wear them effectively. Some, of course, learn more rapidly than others. Some expect to enjoy their first meal as much as they would if they still had their natural teeth—with which they have been masticating for years. People who "eat corn off the cob" have acquired this "art."

Practice chewing before meal time comes. If you practice daily with chewing gum, seedless raisins, dried beef or food of similar texture, you will make incomparably faster progress than if you wait for regular meals.

In biting an apple or eating corn on the cob, your actions are the reverse of those to which you were accustomed with your natural teeth. When you had your natural teeth, the apple was placed between the teeth and the jaws were closed upon it; as you closed upon it you pulled the apple away. Seldom is a patient with artificial teeth able to eat it in this fashion. However, with your mouth partly open, you may press the apple against both upper and lower teeth in such a way as to more securely seat the dentures. As you press, close your jaws together and a portion of the apple will be cut off. Then, the rest of the apple may be withdrawn. You will learn that to pull upon objects which you are biting, tends to displace your dentures. Also, you will find that you can more easily masticate small portions of food than larger ones.

Your upper denture may easily be removed, if you will place the index finger of your right hand over the left border and, using the cheek bone as a fulcrum, press the denture down; this action at the same time raises the cheek and allows air to enter beneath the base. This method of removing it may prevent you from forming a habit in removing the denture in some way which will prove undesirable in retaining it in the mouth.

**Cleansing.**—As is true of natural teeth, artificial dentures become deposited with mucous and solid matter of the saliva (salivary calculus). In order to preserve the appearance of the dentures and assure comfort in wearing them, they should be cleaned at least twice every day. Either night or morning they should be scrubbed vigorously. For this purpose a vegetable brush, such as is used in cleaning vegetables for cooking, may be used advantageously, with baking soda as a cleanser. Occasionally, if the dentures have been neglected for some time, "Bon Ami" or pumice soap may be employed with discretion.

In cleaning the upper denture, it should be held in the palm of the hand and scrubbed vigorously. In cleaning the lower denture, it should be held differently since it is more easily broken, or if not broken, a metal base may be bent. One wing at a time of the lower denture should be held between the thumb and fingers while scrubbing.

Aluminum and gold base dentures are, of course, much more easily kept clean; on this account, together with the fact that metal is more compatible with the tissues of the mouth, just a little attention will make your experience with them much more delightful.

The continuous gum, or platinum base porcelain gum denture, is immune to the secretions of the mouth and consequently needs little attention, so far as cleansing is concerned. This denture is as easily cleaned as a piece of cut glassware, and similar care should be exercised in handling it.

**All Dentures May Need to Be Refitted.** If your teeth were surgically removed and your mouth prepared for artificial dentures, you may expect greater satisfaction than if your teeth were "just pulled." If dentures were inserted immediately after your teeth were removed, you may expect your denture-wearing experience to be more satisfying than if you had no teeth of any kind for a number of months; you will not have had time or opportunity to form habits or develop movements of your jaw which are unfavorable to the retention and use of dentures. Proper preparation of your mouth and immediate insertion of dentures tend to preserve the correct relationship of

your jaws, to maintain the proper distance between nose and chin, to prevent the cheeks from falling in, and to insure or improve your characteristic facial expression.

While some patients find the wearing of dentures a comparatively satisfactory experience from the day they are first inserted, it is morally impossible to tell any patient that this will *certainly* be true of his or her case. If no marked change in the tissues takes place after the dentures are inserted, they may be worn successfully during a long period of time. Usually, however, the tissues change to such an extent that after a few months at most the dentures become too loose for comfort or efficiency, although they may still serve to improve the appearance. Whenever the dentures have been rebased or reconstructed, the tissues may continue to change, and they may again need to be adjusted. Because of the fact that the first dentures usually need to be taken care of in this manner, they have been called by some "temporary" dentures.

You may be satisfied with your dentures and believe them to be perfect, nevertheless, you should visit your dentist at least once a year and give him an opportunity to inspect them. Changes may take place in the tissue without your knowledge that would destroy their efficiency. Often a total loss of natural expression may be avoided.

Because dentures are constructed and become adapted to tissues which no longer change sufficiently to make imperative rebasing or new dentures, such dentures have often been called "permanent." Often, without any adjustments, these are worn a number of years and not infrequently prove satisfactory throughout the remaining years of life. However, in case of illness, decline of health, or change in tonus of tissues from any cause, it may be necessary to reconstruct your dentures, whether you have worn them for a longer or shorter period of time.

Today, dentistry has advanced to such a stage that comfortable, efficient, esthetic dentures may be constructed for you. If you will give your hearty cooperation by following your dentist's suggestions, the satisfaction to be found in the wearing of artificial dentures will be greatly increased, and your experience may be gratifying indeed.

# INDEX

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Y